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A VIVIPAROUS FLY.

BY REV. SAMUEL LOCKWOOD, PH. D.

The question, which is the mother of the chicken, the hen that laid the egg, or the hen that hatched it, would have no place in casuistry if all hens produced their chickens ready made. And there is a great deal of difference between the fly that lays simple eggs, and the one that brings forth living grubs. Thus it was, that what we beheld on the 15th day of June had for us all the novelty of a new sensation. The day was very warm, and I was about leaving my study, when my attention was drawn to a peculiar looking fly on the window. As it was quite large, it occurred to me that it would make a nice morsel for the tree toad in the fernery; so the intruder was captured, and I was about presenting the prize to my pet with goggle eyes, but an open countenance, when a sudden change came over my mind; for in the palm of my hand appeared what I took for eggs of an elongate form. My pocket lens at once showed me that these were not eggs, but real, live maggots, each about .06 of an inch in length; and there, right under my own eyes, even in my hand, the parent fly was busily depositing these little squirming things. The fly continued emitting the grubs, almost without cessation, in numbers varying from one to three at a time. They were very active, twisting themselves into animated knots, each containing from three to six individuals. The entire number of grubs emitted was sixty-one; although it may possibly have been more, as I could not find out whether

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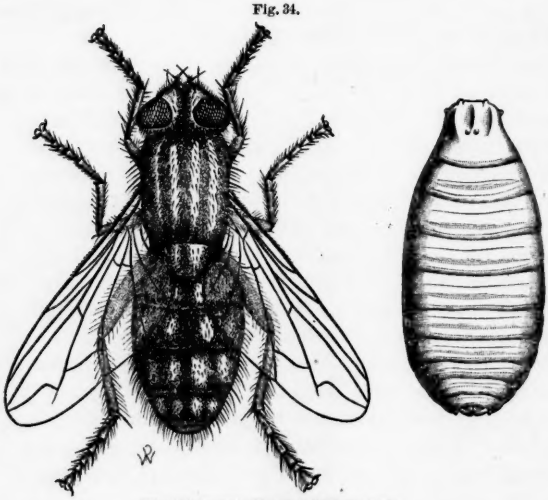
any had been lost during the act of capture. I put the parent fly and about half her progeny into spirits. They were quite active in the strong 95 per cent. alcohol, and lived a good while, although the fly soon died.

Dr. Packard has kindly determined the species for us, and its systematic name is *Sarcophaga carnaria* Linn. (Fig. 34). Though ignorant of the habits of this curious fly, I resolved to make an effort to raise the remaining larvæ. They were now three hours old, and the little things were becoming less active because of the de-

Fig. 34.



The Viviparous Fly and its Pupa Case.

siccating effect of the hot atmosphere. There was no time to lose, so I took a flower-pot, and filled it with porous or sandy earth, and set the pot in a saucer with sufficient water to make it a little moist. Next a bit of fresh kidney fat was put on the earth. On this flesh I laid the tiny grubs, and was soon gratified with seeing the most vigorous of them instinctively recede into the folds of the fat, and thus disappear. A glass tumbler was next put over all, and the arrangement was complete.

Four days' absence from home, and no observations. The larvæ were now a little over five days old and, with the exception of one,

had all entered the ground. This one, which lay between the flesh and the earth, was the straggler of the company. Perhaps it was weak, as it was making ineffectual efforts to follow its companions in their search for proper places for their pupa sleep. But why should it be weak? It certainly was as large — it seemed, I thought, even larger than any of those that had successfully retired. Pray, you, who think that instinct cannot err, are there not larvæ which are gluttons? Or, turning to the man of facts, do larvæ ever overfeed? Whatever the facts may be, the case suggested parallel instances, wherein bipedal gourmands had found it difficult to get away from the relics of the feast, although all else were comfortably off to their dormitories.

I now carefully examined the earth in the flower-pot, and found the larvæ of large size and in holes reaching nearly to the bottom of the pot. They are now six days old, and have left the flesh just half a day. Measuring one of these white maggots of the average size, its length in fractions of an inch was .50 and the breadth was .25. It should be remembered that, generally, larvæ when disturbed contract their dimensions. The same larva when in motion was in length .85. One of these fully grown larvæ (Fig. 35) was put into alcohol of ninety-five proof. It continued quite active for 84 minutes, and sustained life in this element 134 minutes, all of which time it was completely immersed in the fluid.

Fig. 35.

Larva of Flesh Fly.

June 22d.—The larvæ have taken on their brown pupa cases, and pretty things they are, of a cylindrical form, with an erect little fringe at the posterior end, something like the crown on a whortleberry (Fig. 35). There are still three of these white grubs that have not yet taken on their pupa change. These, though rather lively when disturbed, like other indolent people, must be regarded as laggards, for all that, and so were taken out and devoted to experiment. One was immersed in clear turpentine, another in Fowler's solution of arsenic, and the third in essence of peppermint of full strength. Repeating the previous experiment the results stand thus:

A fully grown larva six days old in 95 per cent. alcohol was quite active for 84 minutes, and lived 134 minutes; of the fully grown larvæ seven days old, the one in turpentine spun rapidly in the fluid, and motion ceased in 27 minutes; the one in essence of

peppermint kept up motion for 70 minutes; the one in Fowler's solution only ceased motion at the end of 53 minutes.

In the light of such facts, what reprobation is too severe upon the useless and cruel practice of drenching horses with violent medicaments for the bots? The ailment thus known is due to the presence in the animal's stomach of the larvæ of the bot-fly (*Gastrophilus equi* Fabr.). By its formidable mouth-hooks this larva clings to the walls of the stomach. Now it must be evident that by such methods of treatment, either to kill this parasite, or detach it from its hold would require medicines in such quantity, and of such power, that death to the poor animal would become inevitable before even its tormentors had been materially affected. Scarcity of specimens limited the experiments. I had meant to try the effect of suffocation, by immersing them in some one of the animal oils, for it is possible that herein may be found a simple remedy for that malady in horses.*

July 6th.—The glass on the flower-pot has been carelessly displaced several days. I noticed certain depressions in the earth, such as are made when little holes are filled up by the crumbling of their sides. The sight was ominous. Imagine the feelings which prompted me to exclaim suspiciously, "The imagines are gone." Alas, it was so! From the dryness of the depressions, and other indications, I was satisfied that the perfect flies had taken flight on the Fourth of July—thus, in a way against which no despot could demur, they had entered on their freedom on Independence Day! All this was very fine; but believing that patriotism should not extend to flies, the whole transaction did violence to my scientific instincts. In chagrin I slowly removed the earth

* Long ago my attention was called to the tenacity of larval life when exposed to poisons. I was forced by the claims of justice to take part in a toxicological examination of the internal organs of a person who had been nine months buried. These were put in a large glass jar, and the jar filled with water. It was summer. A small portion of the viscera rose above the fluid. In three or four days, I noticed the presence of a great number of large white larvæ, doubtless of the common blow-fly. We obtained enough bichloride of mercury, to establish the fact that the woman had died by taking a very large quantity of this terrible poison. Naturalists know how well this drug will preserve animal tissues. And in this case, the blood in the capillary vessels was of a bright color, as if fresh. And despite the presence of so much poison, the larvæ grew. Whether they would change to flies, I cannot say. Another case is that of the horse of a friend, which was injured by accident and had to be killed. The animal was opened, and the walls of the stomach were found to be covered with the larvæ of the bot-fly. A piece of the stomach was spread on a board in the sun. Some turpentine was poured on the larvæ, with but little effect, as not one was detached, when it was examined an hour afterwards. Some whale oil was then poured on them. They let go immediately, and soon all died.

from the pot. There were the little coffins—eight of them, and all empty. One was so much smaller than the others, that I concluded it must have contained a male. Very pretty things were these little cylindrical cases — the pupa coverings. (Fig. 34). At the thicker end a tiny lid was uplifted, much as if the sawn-off end of a cocoanut should serve as a lid to the shell, and should be raised to let out a captive bird.

So each having made for itself a little coffin had lain therein just thirteen days. "*Thirteen* days," whispered a friend, a little superstitious about that number. "*Thirteen* days! The fault of their escape is not yours at all. It is a clear case of bad luck." Well, my good friend, your theory is charitable at the least. But in my humble and penitent judgment, it does not condone the blunder which at the auspicious moment allowed the prize to fly away. Nature, like the Oracle, exacts of her inquirers watchful attention.

THE PRAIRIE BIRDS OF SOUTHERN ILLINOIS.

BY ROBERT RIDGWAY.

HAVING familiarized the readers of the NATURALIST to some extent with the general character and appearance of the prairies of Southern Illinois in our article on "The Woods and Prairies of the Upland Portions," I shall now give an account of an ornithological reconnoissance of Fox Prairie, in Richland county, made in the summer of 1871 As this reconnoissance resulted in the discovery of several species of birds new to the state,* a few details concerning it may not be uninteresting to our readers. The field of our observations was a prairie of considerable extent, lying about four miles to the westward of the town of Olney, on the Ohio and Mississippi Railroad, and is merely one of the numerous arms or bays of the Grand Prairie which extend eastward into the forest region of the Wabash valley.

My companions and I arrived at it a little before noon, and saw before us the usual modern prairie prospect. A rolling plain spread away from us, the farther side bounded by the border of timber, while the prairie itself was treeless, except where some

*See AMERICAN NATURALIST, Vol. VI, July, p. 430.

stream was followed by a narrow line of thickets with a few large trees interspersed. Around us were the tangled thickets which we have before described, while the small, but growing trees which sprang up among them gave plain evidence of the gradual encroachment of the woods upon the original prairie. The herds of horses and cattle which dotted the gently undulating surface of the prairie, and an occasional neat frame farmhouse, with its attendant fields and orchard, made us realize that we were yet within the bounds of comfortable and advanced civilization. Just before us the prairie was intersected by a ravine, through which ran a small stream whose narrow valley was filled with a thicket of varied shrubbery, and the brook itself bordered by a few large-sized trees, which were chiefly the white elm, several kinds of oaks, and an occasional cottonwood.

The day was a delightful one; the sky without a cloud, and, though the heat ranged above 80°, the fresh prairie breeze tempered it to a delightful mildness. As we rested in the shade of a large elm tree in the hollow, and reclined on the cool soft sward, our ears were delighted by such a chorus of bird-songs as we have heard nowhere else. Among the leafy branches overhead the orioles (*Icterus Baltimore*) whistled their mellow flute-like notes, and the little greenlets (*Vireosylvia gilva* and *V. olivacea*) cheered us with a softer warble or richer chant. The birds of the meadow were chanting their several ditties all around us on the open prairie, while the frequent soft refreshing prairie breeze wafted to us from the groves the songs of the woodland species.

In the tangled thickets and scrubby jungle near the border of the woods the finest songsters were found. There the mocking birds (*Mimus polyglottus*) fairly filled the air with their rich medley of inexhaustibly varied notes, the singers leaping in restless ecstasy from branch to branch, with drooping wings and spread tail, or flitting from thicket to thicket as they sang. The brown thrasher (*Harporhynchus rufus*) poured forth a sweet and ceaseless accompaniment, as he sat perched sedately upon the summit of a vine-canopied tree — a contrast in bearing to the restless, sportive Mimus, his rival in song. The yellow-breasted chat (*Icteria virens*), a very abundant and characteristic species, appeared to be straining himself to produce the oddest and most unusual notes he could invent, the singer often going through grotesque and extravagant antics — flitting upward, and then descending by jerks,

his wings and tail raised and legs dangling — the whole time singing with all his might. Mingled with these, the loudest songs, were heard the sweet sad chant of the little field sparrow (*Spizella pusilla*), the pleasant cheerful notes of the ground robin, or "chewink" (*Pipilo erythrophthalmus*), the rich whistlings of the cardinal grosbeak (*Cardinalis Virginianus*), and the glad "bob-white" of the quail (*Ortyx Virginianus*). During a lull in the chorus we heard, from the depths of the thicket, a very curious gabbling, or sputtering song, which was entirely new to us. We hastened to the thicket, and, entering it as far as possible, lay in wait for the strange songster to resume his vocal performance. In a few minutes a little grayish bird carefully approached, flitting cautiously from twig to twig, now and then halting, and, after uttering the peculiar notes which had attracted our attention, would stretch out his neck and eye us with great curiosity and evident suspicion. After observing him carefully to our satisfaction at a distance of hardly a rod, we found that he was Bell's greenlet (*Vireo Bellii*), a species of the plains east of the Rocky Mountains from Texas northward, and not before detected east of the Mississippi river. After we had become satisfied of his identity we shot him; but upon attempting to secure our prize we found the briery undergrowth too intricate and powerful to allow a passage through it. In nearly all the thickets others of the same species were frequently heard, so that it appeared to be common in that locality. The little white-eyed greenlet (*V. Noveboracensis*) was also common in the same thickets, and was easily distinguished by his well-known notes, an attempted translation of which gives it the local name of "chickty-beaver bird." As we remained patiently watching for the specimen of Bell's vireo, spoken of above, other little birds would now and then hop cautiously near us, or flit through the undergrowth before us. Among these were recognized the chestnut-sided warbler (*Dendræca Pensylvanica*), the golden winged warbler (*Helminthophaga chrysoptera*), and a pair of mourning warblers (*Geothlypis Philadelphia*). The first two species represent in the scantily wooded portions the cærulean warbler (*D. cærulea*) and the blue-winged yellow warbler (*H. pinus*) of the forests of the bottom-lands.

In the open groves at the border of the timber, the usual woodland species were noticed; and among them, the vermilion tanagers (*Pyranga æstiva*) frequently warbled their robin-like, but

vigorous and well-sustained song, the blue jays (*Cyanura cristata*) squalled and chattered as they prowled among the branches; while the red-headed woodpeckers (*Melanerpes erythrocephalus*) frolicked among the trees. The most abundant bird besides the foregoing species was the tufted titmouse (*Lophophanes bicolor*), which nearly mimicked the jays in both habits and notes.

On the open prairie the birds were all entirely different. The meadow lark (*Sturnella magna* — the true *magna*, and not at all approaching *S. neglecta*, in either manners, notes or plumage!) was the most conspicuous, from its size and the plaintive sweetness of its song. The "dick sissel" (*Euspiza Americana*) was perhaps the most abundant bird, and the males were perched upon the tall coarse weeds all around us, chanting their vigorous but rude ditties. Henslow's bunting (*Coturniculus Henslowi*) and the yellow-winged bunting (*C. passerinus*) were scarcely less abundant, and like the dick sissels were perched upon the tops of the weed-stalks, uttering their simple, abrupt lisping songs. Though we had never met with Henslow's bunting before, we found it to be much more common here than the *C. passerinus*, and in a little while easily succeeded in securing seven fine specimens. At the edge of a pond we saw what we thought to be the *Passerculus savanna*, but the bird escaped by running into the grass after we had crippled it. Over the surface of the pond were flitting and hovering a couple of black terns (*Hydrochelidon fissipes*), while among the rushes and sedges of its border the red-winged blackbirds (*Agelæus phœniceus*), and both species of marsh wrens (*Telmatodytes palustris* and *Cistothorus stellaris*), were nesting; and when away from the pond, we were certain that we heard the harsh grating notes of the yellow-headed blackbird (*Xanthocephalus icterocephalus*), well known to us, but we did not see this species there. In the grassy portions of the prairie the field plover (*Actiturus Bartramius*) was more or less common, and, except the killdeer (*Ægialitis vociferus*), was the only other species of the family observed there. The lark bunting (*Chondestes grammaca*) was more or less common about the border of the corn-fields and scattered groves along the edge of the prairie, and we listened to its vivacious and unusually vigorous song with more pleasure than we had felt upon hearing any other bird during the day, for we regard this bird as the finest singer of its family on the continent; its sprightly, remarkably continued song, having a peculiar emo-

tional trill in various parts, and such beautiful rising and falling cadences, in addition to its other pleasing qualities, that we consider it unequalled in these respects among all the numerous fringilline songsters of the United States. A frequent companion of this species was the indigo bird (*Cyanospiza cyanea*), and more rare one, the grass, or bay-winged bunting (*Pooecetes gramineus*). Besides the species named, but few birds were noticed that day, and these were the more generally distributed species, which are hardly worthy of mention, as the catbird (*Galeoscoptes Carolinensis*), red-bellied woodpecker (*Centurus Carolinus*), flicker (*Colaptes auratus*), and such species as are seen every day in nearly all localities. Once a pair of croaking ravens (*Corvus carnivorus*) made their appearance, and after circling about over the border of the woods for a few minutes, left for the heavy timber of Fox Creek bottoms. The red-tailed and red-shouldered hen hawks (*Buteo borealis* and *B. lineatus*) were occasionally seen, while now and then one or two swallow-tailed kites (*Nauclerus forficatus*) would be noticed floating about in broad circles in the clear blue sky, usually accompanied by the Mississippi kite (*Ictinia Mississippiensis*). The little sparrow falcon (*Tinnunculus sparverius*), the sharp-shinned and Cooper's hawks (*Accipiter fuscus* and *A. Cooperii*), completed the list of birds of prey which we observed that day.

Early in August of the same summer we visited this locality a second time, and found its entire aspect changed. The season of severe drought having passed, we found a profusion of flowers giving a gay and varied color to the prairie, which before was comparatively brown and sober in the appearance of its vegetation. The birds which were most conspicuous were nearly all different from those noticed at our former visit. The mocking birds, brown thrashers and chats, were silent, while a few of the other singers occasionally cheered us with their song. The shrill screech of a very large species of Cicada repeatedly startled us as we brushed against a weed, while numerous varieties of grasshoppers were far more noisy than the birds, and seemed almost the only active beings during the sultry noontime of that cloudless day; for the thermometer stood in the nineties, although the heat was considerably tempered by a steady refreshing breeze. To compensate for this silence of the birds, however, as we came upon the open prairie, a beautiful and unlooked for sight attracted our

attention. Numbers of exquisitely graceful swallow-tailed kites or "snake hawks" (*Nauclerus forficatus*, also locally known as "fish-tail hawk") were seen sailing about in every direction; we were completely transfixed by the beautiful spectacle they presented as they floated about in graceful circles, while they were so unmindful of us as to pass repeatedly within a few yards of us. Soaring gracefully above them with a similar flight were smaller numbers of the "blue kite" (*Ictinia Mississippiensis*), which, more suspicious, seldom approached so near. The latter birds, though far less striking in appearance than the swallow-tails, were nevertheless superior to them in power of flight, for they had a very interesting habit of suddenly pitching downward from a great height almost to the ground, and again ascending by a steep angle nearly to the level from which they started; the whole performance accompanied without a single flap of the wings, which in the descent were merely extended at the elbows and inclined inwards at the tip, and the rapid fall checked by suddenly extending the wings, which were thus held motionless as the bird mounted again. Frequently two or three would pass each other at different angles as they performed these beautiful evolutions, and presented a sight pleasing and interesting in the extreme. The power of flight of these kites may be better appreciated by the fact that they frequently appeared and passed rapidly and easily by the turkey buzzards (*Cathartes aura*) which happened to be sailing majestically in the same direction. The swallow-tails were never noticed performing these evolutions; though for ease and grace their buoyant, floating flight certainly cannot be excelled.

The swallow-tails were so numerous and tame that once, when half a dozen or so were sailing about, we killed one with each barrel of our gun, in quick succession. A couple of full-grown young of this species were seen upon a dead tree along the stream, and while we were watching them the parent bird approached, evidently with food for them, for they commenced dancing up and down upon the branch, and whistled impatiently, when she hovered over them. The Mississippi kites would never approach us near enough for a shot, so that we found them far more difficult to shoot than the swallow-tails. The three specimens obtained we secured by stratagem; our most successful plan being to approach them in our wagon. These kites were frequently observed resting upon the tops of the dead trees along the stream, and by approach-

ing with the team until we were concealed for a moment by the intervening underwood, I would jump out and leave my companions to keep on with the wagon. While the unsuspecting kite was intently watching the passing team, I found it usually quite easy to steal through the thickets near enough to the tree to shoot it. In this manner I succeeded in shooting three fine specimens during the day.

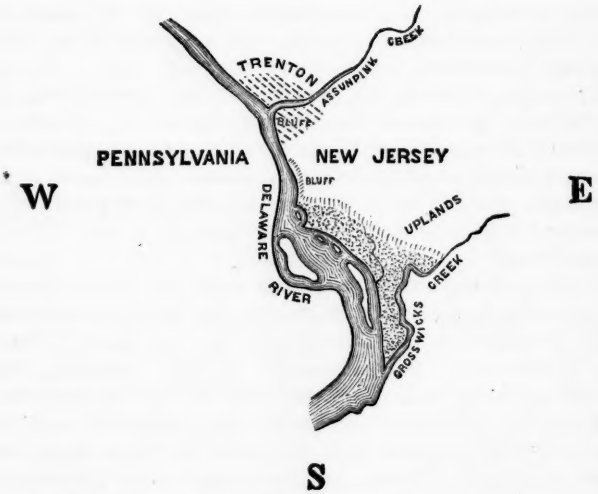
While driving across the prairie, in the course of my hunt after these birds, I observed what appeared to be a Mississippi kite perched upon a dead tree in a bushy ravine. We approached it as described above, and as we drew nearer, we noticed something in its appearance which caused us to see that it was not an *Ictinia*. We were almost near enough to shoot from the wagon, when it flew, and began circling about, when it was immediately assaulted by two or three Ictinias, that continued to annoy it. When immediately overhead I shot at it, but without serious effect, for it immediately flew straight into a large elm tree in the ravine, and alighted among the branches. As it soared about above us I immediately recognized it as the *Asturina plagiata*, a species which is so strongly marked in all its characters, the plumage especially, that no other hawk could possibly be mistaken for it by one at all acquainted with this family. I succeeded in getting another shot at it, but the distance was so great that the bird escaped.

In this article I have named the more abundant and characteristic birds of the prairie portions of southern Illinois. Future observations, in such favorable localities as that explored by us, will no doubt reveal many additional, and perhaps several unlooked-for species, when we take into consideration the fact that my acquaintance with the prairie avi-fauna depends solely on these two trips. The number of species actually observed in the locality, numbered about ninety-five on each occasion; while the species breeding in the immediate neighborhood are about one hundred and forty, a very rich avi-fauna for a restricted locality, when the fact is taken into consideration, that of this number only about twenty-five are water birds — the remainder of one hundred and fifteen species of land birds being, perhaps, as large a number of regular summer residents as any single locality in North America can boast.

OCCURRENCE OF IMPLEMENTS IN THE RIVER DRIFT AT TRENTON, NEW JERSEY.

BY CHARLES C. ABBOTT, M.D.

THE discovery of unquestionable river-drift implements in this country has been an occurrence of great rarity, in comparison with the extensive unearthing of such implements in Europe and



more especially in France. There does not seem to be any known stratum of river-drift that contains such specimens of archaic implements as have been found by archæologists, *in situ*, at Amiens and St. Acheul,* France, and therefore the occurrence of a single

* We have already called atte tion to the similari y of certa n rudely chipped implements found near Trenton, N. J. (Amer. Nat. vo'. VI. p. 146, fig. 9), to those found at St. Acheul, and Prof. Wyman (Fifth Ann. Rep. of Peabody Museum of Amer. Archæol. and Ethnol. p. 27) also mentions this similarity, saying of two or three specimens sent him, "except for their material, *they* could hardly be distinguished from them." These

specimen of strangely shaped stone, that appears to be an "implement" may be looked upon perhaps, very doubtfully, as establishing the facts that it is a stone that has been so shaped by human hands; or if so that it is of the same date as the containing bed of river drift. Such doubts, we confess, passed through our mind as we dug out from a gravelly bluff or hillside, then being removed, the specimen to which we would first call attention, but before describing it we will mention the characteristic features of the gravel bank itself, as it was when this specimen was found.

The physical geography of the locality is very nearly as follows: The south bank of the Assunpink Creek, where the stream empties into the river, was originally a high gravelly bank, having its greatest elevation at the mouth of the stream, and gradually disappearing as it extended up the stream, or in an easterly direction, almost, at this point, at right angles with the river. The northern shore sloped gradually to the creek; the high ground being a full half mile from the stream.

As we pass down the river shore, on the New Jersey side, we find the same gravelly bluff reappearing at the river side, after a stretch of lower and meadow-like land, now all built upon; and this river side bluff, after extending a distance down the stream of half a mile, suddenly leaves the river, trends eastward, and leaves between it and the river, the extent of meadows that is indicated by the dotted portion of the map.

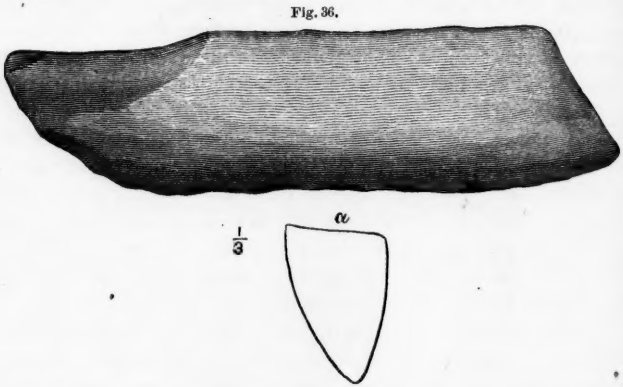
On this meadow, and in the uplands above (see map), and also in the graves in the hillside dividing the two sections of meadow and upland, are found the thousands of "relics" such as we have described somewhat in detail in vol. VI, of this journal. The specimens that are more particularly described in this paper were found in the bluffs, at those points where the word "bluff" is printed on the map. At these two points, the river on the one hand, and "city improvements" on the other, have exposed the hillsides and made such sections of them as enable the observer

specimens, however, are not true drift implements, inasmuch as they are also found upon the surface, associated with ordinary "Indian relics," and when found in gravel, it is nearer the surface of the ground and in such position as renders it possible that they may have gradually worked down to the depth at which they occur. Of the age, as a class, however, of these rude implements, we maintain that they are much older than the finely worked "relics" which are, except when in graves, strictly surface-found implements; that is, stone implements discarded and lost previous to, and at the date of, the arrival of European settlers; who introducing metals, especially iron, made the stone weapons of the Red man comparatively of little value.

to see their geological construction at a glance. This construction is in each case alternate layers of fine sand and gravel, the latter being far in excess of the former; and we have designated the specimens here figured as "drift implements," and consider them as wholly different from the rude implements already referred to, inasmuch as all three were taken from this gravel at great depth, and all *beneath undisturbed layers of fine sand.*

Figure 36 represents the first of the three "drift" implements found deeply in drift gravel. It was brought to light in September, 1872, in removing the steep hillside that formed the east side of Cooper street, near Factory street, in the city of Trenton. The specimen itself, when discovered by us, was lying *in situ*, sur-

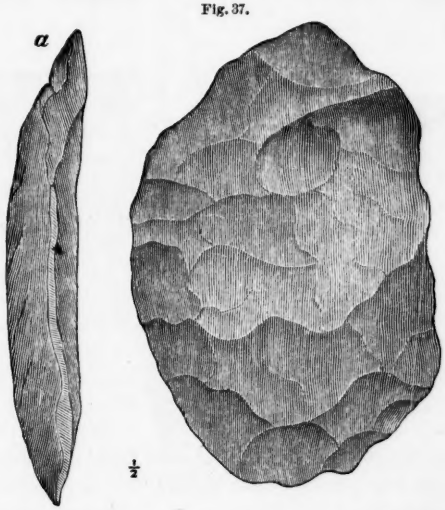
Fig. 36.



rounded by gravel, and there were two layers of undisturbed sand of one foot and twenty inches respectively in thickness above it; between these sand strata was a heavy stratum of fine gravel; above them another; and the loam above that. The stratum of gravel in which the specimen was found was three feet in thickness above the specimen, which was about two feet above the level of the street. The depth from the surface of the ground to the specimen, which was ascertained before the removal of the implement from its bed, was sixteen feet. The specimen was lying in a horizontal position, in fine gravel, and attention was drawn to it by the cutting edge projecting from the face of the hillside or bluff. We were assured by the men who were carting this gravel, that the week previous they had met with two slabs of stone, a foot or

more square, with "queer figures cut deeply into them." We failed to trace these up, and give the rumor only as we heard it. For ourselves, we do not doubt the occurrence of such stones, but the "queer figures" may not have been of human origin. The implement which we represent in Fig. 36 is a mass of reddish brown stone, compact, laminated and susceptible of a high polish. It appears to have been a hatchet with the handle "all in one." The end of the blade has been extended beyond the back of the implement, one inch and a half, giving the specimen a very knife-like appearance. The handle is three and one-quarter inches in length,

Fig. 37.

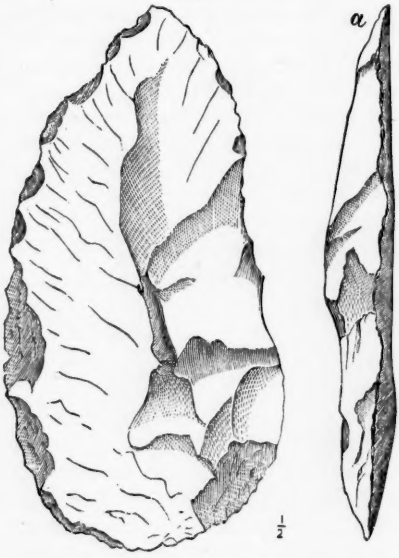


and has been formed by cutting through *one* of the layers of the stone, thus making it much thinner than the rest of the implement along the "back" of the cutting portion. The specimen measures, handle and blade included, along the back, nine and one-half inches; along the front or edge, eleven and one-quarter inches. The cutting-edge has undoubtedly been chipped, and although the specimen is now much water-worn, the flaking can still be seen extending along the whole edge. Had this specimen been found upon the surface of the ground no one would question its being a "relic;" and found where and as it was, we believe it to be a

"drift implement," because of this very chipping of its cutting edge. It is inconceivable to us that any amount of water action, or rough and tumble existence with moving gravel, or even any action of a glacial nature, could produce this chipping along the edge, and conveniently add a handle to an accidentally produced cutting implement.

Figure 37 represents an implement of opaque yellowish quartz that bears more resemblance to the European forms of drift implements than does the preceding. In Reliquiæ Aquitanicæ,* there is figured a "large broad flake, worked into a lanceolate form by careful chipping along the edges of the outer face," which specimen is quite similar to the one we have figured. The specimen, figure 37, has evidently been broken off from a boulder, and subsequently chipped along its edges. It is irregularly lanceolate in form, five and one-quarter inches in length, and three and one-half inches in greatest width. Although both faces are now equally water and weather-worn, it is shown by the specimen's concavo-convex shape, that the latter is the outer or natural surface of the stone. It is slightly darker in color, and more irregular, as though the stone had been somewhat chipped before the flake itself was detached.

Fig. 38.



This chipped flake was found in the same gravelly bluff, as the preceding, but at some distance from it, being the point previously referred to as immediately facing the river, as shown in the map by the word "bluff." It, too, was found by the writer *in situ*

* Rel. Acq. A. pl. III, fig. 1.

and beneath an undisturbed stratum of fine sand about twenty inches in thickness. It is above this stratum of sand, in the gravel that has only the loam above it, that very many of the rude implements have occurred, to which attention was called in the NATURALIST, in March of the past year.

Figure 38 represents the third specimen of drift implements which we have so far discovered in the Trenton gravels. It is a flake of sandstone rock, six and one-half inches in length by three and one-half inches in width. This specimen differs materially from the preceding, in being perfectly flat upon the under surface, and flaked to the edges, from a point upon the other side, by detaching large scales, all starting from this one point or "bulb of percussion." This specimen, therefore, bears much resemblance to the rude implements we frequently find on the surface, and which are popularly called "turtle backs." They are either finished implements or "cones," from which flakes for arrowheads were detached. We incline to the former opinion.

This drift implement (Fig. 38) was found within fifty yards of the first specimen we described, but above it geologically, having but a single layer of undisturbed sand above it. The specimen itself was found by the writer, *in situ*, immediately beneath this layer of sand, at a depth of about eight and one-half feet from the brow of the hill.

To briefly sum up the reasons for separating the above described specimens from the relics of the surface, and the rude implements of the upper gravel and surface, we have but to say that having found them in position, beneath undisturbed strata of sand, we cannot but maintain their greater age; and as we have found three specimens, we consider that each proves the human origin of the other, and that collectively they show that they are true drift implements, fashioned and used by a people far antedating the people who subsequently occupied this same territory, and have left such abundant traces of their presence.

Had but a single specimen been found, we might reasonably, perhaps, applied to it the doctrine of chances, and maintained that it was merely a freak of nature, but the occurrence of three specimens so near each other effectually disposes of the justice of such an opinion, and we must admit the antiquity of American man to be greater than the advent of the so-called "Indian."

COMPARISON OF THE GLACIAL PHENOMENA OF NEW ENGLAND WITH THOSE OF EUROPE.

BY A. S. PACKARD, JR.

DURING a hurried tour through the Alps and Norway, I endeavored to observe marks of ancient glaciers in those countries in order to compare them with the phenomena to be observed in our northern states. The impression made on my mind, and I doubt not on that of other Americans who have travelled in the Alps and Scandinavia, was that the evidences of the former presence of glaciers, in valleys at the heads of which are glaciers now existing, were scarcely more distinct than in the valleys of the White Mountains, of the Adirondacks and even the coast of New England.

As one approaches the Alps from the valley leading from Munich up to Kempten, it could be readily seen that near the lower mountains the valleys were flanked by rounded moraines, clothed with pines and firs, and no better marked than those in the valley of the Saco about Conway. Their presence was revealed by the clearings made in the forests in the same manner as in the White Mountains and the Adirondacks. In one important feature the marks were less apparent, as one does not see in the Alps the broad trains of boulders so common in New England, since they have been artificially removed * during centuries of occupation of the country.

It was more difficult to detect striated and rounded rocks in the Alpine valleys than I had imagined from the accounts of Alpine geologists and travellers.

It was wonderful how nature has sought as it were to conceal the work of the ice period, through atmospheric agencies, in remodelling the materials of moraines, in reducing their former proportions and covering them up by the rapid growth of forests. The same process has gone on in northeastern America, and it is not improbable that about the same amount of time has been consumed in the work; namely, the ice period was contemporary in

* Professor Guyot informs me that the Swiss farmers often bury the boulders below the reach of the plough. The larger ones are sometimes blasted and split into building stones, while others, as with us, have been used for building fences. In some cantons laws have been enacted protecting the more remarkable boulders. (See NATURALIST, Vol. vi, p. 713.)

both continents. During a stay of nearly three weeks in Switzerland, several days of which I spent on foot in crossing the principal passes, I was unable to find among the specimens, I had endeavored to obtain for the museum of the Peabody Academy, a boulder scratched and polished sufficiently to be a fair sample of such work. Those that I did obtain *i.e.* small boulders, samples of glacial mud and gravel, could easily be mistaken for similar specimens from a glacial moraine at the mouth of the Peabody river at Gorham, New Hampshire. In all respects, this last named moraine is, in its glacial characters, the exact equivalent of the moraines at the edges of Alpine glaciers.

It is not until one crosses over by the great Scheideck Pass into the valley of Hasli that he sees the most magnificent examples of polished and grooved rocks, and on a scale perhaps exceeding anything in America. It was not to be wondered at, however, that geologists had been slow to realize that so large a portion of Switzerland had been glaciated.

In Sweden, but especially in Norway, where there are large glaciers and very extensive *mers de glace* on the summits of some of the mountain ranges, the ice marks are everywhere present, but scarcely more apparent than in the White Mountain valleys. At one place on a low rocky point projecting into the Sogne Fjord, there was a magnificent display of deeply grooved and furrowed rocks. But even with the marks at this locality, the enormous grooves on a hill within the city limits of Salem would compare favorably. In Norway, I was not able, so hasty was my journey over the country, to secure any samples from moraines recent enough to compare with moraines in the White Mountains. In Wales the glacial phenomena are on a diminutive scale compared even with the White Mountains, but in walking through the celebrated Pass of Llanberis the polished rocks, boulders and moraines, from one of which I was able to secure samples of glacial gravel, were of the same character as is to be seen in the White Mountains, and scarcely better marked.

Another point of much interest was the comparison of the glacial marine beds of Sweden and Norway with those of New England. While, as is well known, the life of the glacial epoch is almost identical in the two countries, the fossils found at Uddevalla in Sweden, as long since pointed out by Lyell, so exactly repeating the characteristic forms found by Bayfield in the clays of the river

St. Lawrence, and the few species peculiar to each deposit are migrations from the south — it was interesting to see that the lithological characters of the formation were the same in both. Approaching the Baltic coast of Sweden, and nearing the city of Stockholm, the train carries the traveller over extensive beds of clay with exactly the scenic features and color of those of the coast of Maine, presenting long slopes bounded by hillocks of pale gray clay with furrowed sides, worn into the same peculiar shapes by the rains. At the fine museum of the national Geological Survey, under the direction of Professor Torell, I was enabled to see a typical collection of the fossils of these clays. It was interesting to see the *Leda truncata* (L. Portlandica) so abundant in Maine beds, and the *Yoldia pygmæa* not infrequent in the Maine glacial beds. The abundance of this arctic Leda in deposits on both sides of the Atlantic shows how much more uniform was the marine life at that time. Changes in the level of the land, and consequently in its temperature, in the ocean currents, slight though they were, have brought about the changes in the distribution of life in the New England seas. Many arctic species and arctic varieties of species, though still living on our coast, are now to be sought in the abysses of our seas.

The explorations under the auspices of the United States Fish Commission, in the Coast Survey Steamer Bache last autumn (see Prof. Verrill's report in the Amer. Jour. Science, 1872), show how vividly we may restore the ancient marine life of the shores of New England and the St. Lawrence river below Montreal. Here, at a depth of 85–150 fathoms and over, were found living the *Arca pectunculoides*, so abundant in the glacial beds of Norway, though it has not been found in our glacial deposits. The discovery of this and other animals so near our shores, as well as the results of Count Pourtales' researches, and Mr. Whiteaves' dredgings in the Gulf of St. Lawrence, shows that the belt of arctic life as developed on the coast of Finmark at the present day extends southwards in all the deeper parts of the Atlantic ocean north of the West Indies, with its outliers in the Gulf of St. Lawrence. During the glacial period, when the sea stood two or three hundred feet deep over the present coast line of Maine, and still higher over that of the shores of the St. Lawrence Gulf, and Labrador, this belt of life was continuous up to the shallows and estuaries of the land during the period of the deposition of our clay beds. This fact should

stimulate us anew to prosecute with still greater ardor deep-sea dredgings off our coast, particularly the northeast extremity of the St. Georges Banks, with the hope of finding that now strangely interesting shell, *Leda truncata*, which has been brought home from the seas of Greenland in a recent state by arctic voyagers; and on the other hand, to investigate the clay beds of the coast of New England, and Canada and Labrador with the hope of finding the *Arca pectunculoides*, which we can now with some degree of safety predict will be eventually found. The kind of bottom the writer found on the northeastern end of St. Georges Banks, and which proved so remarkably rich in molluscan and vermian life, was a sandy mud, much like that of the richest fossiliferous beds in our glacial formation.

We have but glanced at the identical features of the glacial phenomena of the Alps, Scandinavia and northeastern America, a matter which our geologists have doubtless each observed for themselves, and which struck Prof. Agassiz when he first arrived in this country after his years of exploration in the Alps, and journeys in Scotland and Wales, but which will perhaps suffer repetition in a popular journal of this character. As Humboldt early in this century expressed his delight at finding identical rocks in the New and Old World, the student of the superficial deposits that cover these rocks cannot restrain his delight at finding them almost identical in both hemispheres. Indeed it may be a comfort to the American student of glacial phenomena to know if he is debarred from visiting the glaciers of the Alps or Norway, or even those of the Rocky Mountains, that in the northern states, their marks are as freshly preserved as in the Old World, except at the very edge of the glaciers themselves when photographs will supply the place of actual vision.

THE COTTON CATERPILLAR.

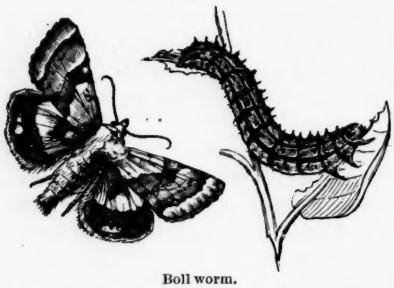
BY LEWIS A. DODGE.

THERE are two kinds of insects which feed upon and destroy the cotton crop. The boll worm (Fig. 39, caterpillar and moth) eats only the bolls or pods containing the unripe cotton lint. It confines

its ravages to the bolls alone and does not trouble the foliage on the cotton plant. The first brood of boll worms always appears in the corn fields, where it feeds on the silk and leaves of the more tender corn until it is large enough to attack the tough cotton pods, eating into them just as the apple worm eats into the apple.

But the insect which we dread, and which we call the caterpillar* (Fig. 40, moth and caterpillar), eats only the leaves on the cotton plant. The boll worm sometimes attacks the long-staple cotton, but only as an attendant on the caterpillar, completing what the latter had begun. We have twice had our cotton fields eaten out completely since the war and consequently have been compelled to learn something about the habits of the caterpillar. In appearance and size it is at first like the canker worm, but towards the latter part of October it becomes much larger and more active.

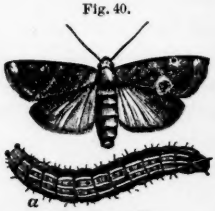
Fig. 39.



Boll worm.

In one respect it differs from the canker-worm—when you touch one, it jumps away three or four inches; but ordinarily it crawls about from leaf to leaf. When first discovered—about the last of July—it is very small, not much larger than the head of a pin and was eating holes through the leaves of the tenderest cotton from the under side. It soon disappeared and in about two weeks we found a new brood which increased in size and numbers much more rapidly than the first. This second brood was confined to spots in the fields, eating all the foliage wherever it began. After eating for about two weeks they began to roll up in the cotton leaves in the form of cocoons and shortly turned into moths, which flew in every direction over the fields and deposited their eggs for

Fig. 40.



Cotton Caterpillar.

*For an account of this caterpillar, the *Anomis xylina*, see the "Guide to the Study of Insects," where Professor Darby relates his experience with it in Alabama.

the third brood. Each female moth is said to lay at least five hundred eggs, so any one can judge how rapid is the increase.

Thus the caterpillars keep on multiplying into new broods till near the middle of November, when the frost kills them off. The common belief among the negroes is that the caterpillar knows when the frost is coming, and takes to the woods, where it sleeps till the next spring, but I have never verified their belief. As the cotton plant gets older and the leaves tougher, the caterpillar increases in size and activity and eats from morning till night. Of course, as the plant loses its leaves, it dries up and the fruit bolls wither and rot, just as apples do under similar conditions. After the worms have taken possession of the fields, it is always estimated that from one-half to three-fourths of the yield has been cut off. We have this year about three hundred acres planted in cotton. At the lowest calculation of price and yield per acre, this ought to turn us in a $16,000 crop; but if the caterpillars get into it, we shall be lucky to get $8,000 out of it.

As to where or how the cotton caterpillar originated, several theories have been advanced. Some say that they came from the Bahama islands to Florida and thence spread up along the coast.* But I suppose they came just as the canker and currant worms came, and it is as easy to account for one as the other. Their development depends much on the state of the atmosphere. Dog-day weather seems to be favorable to their increase and spread, while a hot sun scorches them and renders their food, the leaves, dry and tough. Before the war, they did not appear oftener than once in seven years, and many old and experienced planters say that we have them now oftener, because our method of cultivation is different from theirs and not so thorough. It was always customary to burn off all the cotton fields and old pastures after the frost had killed vegetation, thus destroying any eggs that might have remained unhatched. This practice in many cases is neglected now; and again they say that we put off ploughing up our ground too late; that by ploughing early, the frost has a chance to act on the soil and kill all grubs and eggs deposited under the surface. The darkey also has his reason, which perhaps is as good as any yet assigned. He says the guano brings the caterpillar, reasoning from the fact that it always attacks the rankest cotton

*For an account of the distribution of the army or cotton worm, see the NATURALIST, Vol. iv, p. 52.

first, this having attained its luxuriance through the application of guano. He says the Yankees are so much in a hurry to make money that they use more guano than they ought. Yankees, guano, caterpillars and carpet-baggers are all associated together in his mind. He will not steal guano for this same reason, that he believes it breeds the caterpillars.

We have tried several methods of checking them, but none did much good. We built fires at night around our fields to attract the moths, but they did not seem much inclined to commit suicide. We hired hands to examine the plants and pick off the leaves having eggs on them, but it was a slow and useless job. We heard that insects could not endure the smell of the castor bean plant and so planted rows of them through the fields, but it did no good; on the contrary, they rather liked it. In fact the only effectual remedy was by picking off the worms themselves, thus checking their spread. But one hundred hands picking all day would not gather more than two or three barrels, and at night there seemed to be just as many in the field, though their increase was evidently lessened. Perhaps you say "why not apply carbolic acid to the plants?" We have tried that too, but you might as well attempt to put out a burning house with a pocket syringe, as to sprinkle a field of a hundred acres. How to keep them off, or how to destroy them after they have come, has not yet been discovered.

No one who has not seen them at work, can conceive of the devastation they commit. We have had a field of over one hundred acres eaten out so clean by them in ten days' time, that it had the appearance of having been burnt over by fire. To-day you see only a few here and there; in less than a week the ground, with every cotton plant and other bush, is one squirming mass of worms. They are born to devour and most faithfully do they execute their mission. When they are in full blast, the air in a cotton-field is filled with a sickening odor of the macerated leaves, and I have thought I could hear the noise of their eating and crawling. I have seen ditches a foot deep for miles, filled to the top with drowned worms, and in one instance the wagon rut for eight miles or more was full of a wriggling mass of them. Dogs, geese, turkeys and birds thrive on them, and forsake all other food for them. The negroes' dogs get fat on them alone; the rice birds desert the rice fields in thousands, preferring the worms to the tender rice.—*Adapted from the Boston Congregationalist.*

ON THE GENUS TINOCERAS AND ITS ALLIES.

BY PROFESSOR O. C. MARSH.

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Cope has since called frontal bones), has at present no authority, the specimens described being evidently the posterior horn-cores of other known species. Judging from the description, the name *E. pressicornis* Cope, has no better foundation. 4th, The genus *Dinoceras* Marsh, is distinct from *Uintatherium* Leidy, although perhaps nearly related. 5th, The mammals of the above genera cannot be placed in the order *Proboscidea*, but constitute a separate order, *Dinocerata*. 6th, The presence of a proboscis does not directly result from the osteological characters of this group, but is inconsistent with them; and hence the evidence is strongly against it. 7th, The skull in the Dinocerata presents no distinctive Proboscidian features, and the subordinate resemblance in the limb-bones, I pointed out before Prof. Cope wrote anything on the subject. 8th, The presence of canine teeth and horns, alone, was not stated by me to be characteristic of a new order, but other important characters were mentioned (p. 150). 9th, The canines of the Dinocerata do not correspond to the tusks of the elephant, and the latter are not enclosed between the premaxillary and the maxillary, but are inserted in the former bone. 10th, The nasal bones of the Dinocerata are much elongated, and do not have their free extremities extremely short, or deeply excavated. 11th, The frontals do not extend in front of the premaxillaries; their extremities do not form bony projections like shovels, and they do not support horns or processes at both extremities. 12th, The anterior horn-cores are on the nasal bones, and not on the frontals, and they are not composed externally of the maxillaries. 13th, The middle pair of horn-cores are not on the frontals, but on the maxillaries, their inner inferior margin alone being formed of the nasals. 14th, The tarsus and foot are not strictly Proboscidian in character, but show strong Perissodactyl features, *e.g.*, in the absence of a hallux, and in the articulation of the astragalus with both the navicular and cuboid bones.

The species of Dinocerata at present known with certainty are the following:—*Tinoceras anceps* Marsh, *Tinoceras grandis* Marsh, *Uintatherium robustum* Leidy, *Dinoceras mirabilis* Marsh, and *Dinoceras lacustris* Marsh. To these should probably be added *Megacerops Coloradensis* Leidy.

REVIEWS AND BOOK NOTICES.

CALIBAN: THE MISSING LINK.* — This curious volume of Dr. Wilson's, can nowise be compared with his former works, especially the "Prehistoric Annals of Scotland." Indeed, doubts continually arose, during our perusal of it, whether it really could be classed among the many works that of late have appeared, scientifically discussing the question of the ape-descent of man. This volume consists of fourteen chapters, all quite brief; and but eight of them really touching upon that "missing link," that he assumes the evolutionist to consider as the bridge that crosses the chasm now existing between man and his nearest pithecoid relative. This link is curiously interwoven, as it were, with Caliban of Shakespeare's Tempest; and we have in the two hundred and seventy-one pages of the book, a double essay on evolution and poetry, certainly very novel and entertaining, if nothing more; "the object aimed at in the following chapters," being, according to their author, "to place the conceptions of modern science in relation to the assumed brute progenitor of man, alongside of those imaginative picturings, and of the whole world of fancy and superstition pertaining to that elder time; while also, the literary excellences, and the textual difficulties of the two dramas of Shakespeare chiefly appealed to in illustration of the scientific element of inquiry, are made the subjects of careful study." Dr. Wilson has, indeed, placed the conceptions of modern science alongside the whole world of fancy, but in doing so has, we think, misinterpreted modern science in making the Caliban of Shakespeare's fancy the embodiment of the former's sum total of results.

At the very outset, the author continually refers to the "missing link," the Caliban of Darwin's fancy, a mere hypothetical being to make good that writer's theory; but the evolutionist does not intimate that one, but many, links are gone; a whole section, if you will, in the great chain of being. We doubt not for one moment, that Dr. Wilson himself would claim that the Bushman and the European were far different genera, had some geological cataclysm destroyed the intermediate races; and would deny their former existence. So it is just as reasonable, and no more, to deny that

*Caliban: The missing Link. By Daniel Wilson, LL.D. London. Macmillan & Co. 1873. 12mo, pp. 271.

first, this having attained its luxuriance through the application of guano. He says the Yankees are so much in a hurry to make money that they use more guano than they ought. Yankees, guano, caterpillars and carpet-baggers are all associated together in his mind. He will not steal guano for this same reason, that he believes it breeds the caterpillars.

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In the March NATURALIST (p. 157) there is an article by Prof. Cope, on "The Gigantic Mammals of the Genus Eobasileus," which contains no new facts on the subject, but some interesting additions to the list of errors which I have pointed out in the same number (p. 151). This paper purports to have been read at the Dubuque Meeting of the American Association of Science, but obviously includes the results of Prof. Cope's later investigations, as well as some corrections suggested by my recent criticism. This is equally true of the appended paper, which was first issued separately, and has just been republished, in an amended form, in the "Proceedings of the Philadelphia Academy" (p. 11).

Since the March NATURALIST was published, I have had an opportunity, through the kindness of Prof. Agassiz, of examining a series of photographs of the skull described as *Eobasileus cornutus*, by Prof. Cope. These views fully confirm my previous belief in regard to this specimen (p. 153), viz.: that it belongs to my genus Tinoceras, and hence to the Dinocerata. The species is apparently *T. grandis* Marsh. These photographs, moreover, when examined in connection with remains of Dinocerata in the Yale Museum, show conclusively that Prof. Cope has, from the first, mistaken many important characters of his own specimens, and hence his erroneous conclusions in regard to the group to which they belong. His papers on this subject, therefore, should be corrected on the following points, as well as on those I have already mentioned:—1st, The name *Eobasileus* Cope, is a synonym of *Tinoceras* Marsh, which antedates it (p. 152), and the name of the family, Tinoceratidæ, likewise has priority over Eobasiliidæ, which Prof. Cope has recently introduced. 2nd, The name *Loxolophodon* Cope should not be applied to this genus, as there is no satisfactory evidence that the single premolar tooth to which it was first given is generically identical, and the probabilities are against it. 3d, The species *Eobasileus cornutus* Cope appears to be the same as *Tinoceras grandis* Marsh, which was first described. The species *E. furcatus* Cope, founded on portions of supposed nasal bones (which Prof.

Cope has since called frontal bones), has at present no authority, the specimens described being evidently the posterior horn-cores of other known species. Judging from the description, the name *E. pressicornis* Cope, has no better foundation. 4th, The genus *Dinoceras* Marsh, is distinct from *Uintatherium* Leidy, although perhaps nearly related. 5th, The mammals of the above genera cannot be placed in the order *Proboscidea*, but constitute a separate order, *Dinocerata*. 6th, The presence of a proboscis does not directly result from the osteological characters of this group, but is inconsistent with them; and hence the evidence is strongly against it. 7th, The skull in the Dinocerata presents no distinctive Proboscidian features, and the subordinate resemblance in the limb-bones, I pointed out before Prof. Cope wrote anything on the subject. 8th, The presence of canine teeth and horns, alone, was not stated by me to be characteristic of a new order, but other important characters were mentioned (p. 150). 9th, The canines of the Dinocerata do not correspond to the tusks of the elephant, and the latter are not enclosed between the premaxillary and the maxillary, but are inserted in the former bone. 10th, The nasal bones of the Dinocerata are much elongated, and do not have their free extremities extremely short, or deeply excavated. 11th, The frontals do not extend in front of the premaxillaries; their extremities do not form bony projections like shovels, and they do not support horns or processes at both extremities. 12th, The anterior horn-cores are on the nasal bones, and not on the frontals, and they are not composed externally of the maxillaries. 13th, The middle pair of horn-cores are not on the frontals, but on the maxillaries, their inner inferior margin alone being formed of the nasals. 14th, The tarsus and foot are not strictly Proboscidian in character, but show strong Perissodactyl features, *e.g.*, in the absence of a hallux, and in the articulation of the astragalus with both the navicular and cuboid bones.

The species of Dinocerata at present known with certainty are the following:—*Tinoceras anceps* Marsh, *Tinoceras grandis* Marsh, *Uintatherium robustum* Leidy, *Dinoceras mirabilis* Marsh, and *Dinoceras lacustris* Marsh. To these should probably be added *Megacerops Coloradensis* Leidy.

REVIEWS AND BOOK NOTICES.

CALIBAN: THE MISSING LINK.* — This curious volume of Dr. Wilson's, can nowise be compared with his former works, especially the "Prehistoric Annals of Scotland." Indeed, doubts continually arose, during our perusal of it, whether it really could be classed among the many works that of late have appeared, scientifically discussing the question of the ape-descent of man. This volume consists of fourteen chapters, all quite brief; and but eight of them really touching upon that "missing link," that he assumes the evolutionist to consider as the bridge that crosses the chasm now existing between man and his nearest pithecoid relative. This link is curiously interwoven, as it were, with Caliban of Shakespeare's Tempest; and we have in the two hundred and seventy-one pages of the book, a double essay on evolution and poetry, certainly very novel and entertaining, if nothing more; "the object aimed at in the following chapters," being, according to their author, "to place the conceptions of modern science in relation to the assumed brute progenitor of man, alongside of those imaginative picturings, and of the whole world of fancy and superstition pertaining to that elder time; while also, the literary excellences, and the textual difficulties of the two dramas of Shakespeare chiefly appealed to in illustration of the scientific element of inquiry, are made the subjects of careful study." Dr. Wilson has, indeed, placed the conceptions of modern science alongside the whole world of fancy, but in doing so has, we think, misinterpreted modern science in making the Caliban of Shakespeare's fancy the embodiment of the former's sum total of results.

At the very outset, the author continually refers to the "missing link," the Caliban of Darwin's fancy, a mere hypothetical being to make good that writer's theory; but the evolutionist does not intimate that one, but many, links are gone; a whole section, if you will, in the great chain of being. We doubt not for one moment, that Dr. Wilson himself would claim that the Bushman and the European were far different genera, had some geological cataclysm destroyed the intermediate races; and would deny their former existence. So it is just as reasonable, and no more, to deny that

*Caliban: The missing Link. By Daniel Wilson, LL.D. London. Macmillan & Co. 1873. 12mo, pp. 271.

more human apes have existed, as in the supposed case; and no Caliban, we admit, could have filled that intermediate state which thousands of years and many generations must have done. Could not time have accomplished this result? And what of the argument that the "commencing" man would be too helpless to survive? Are the more anthropoid apes in greater danger during infancy, than those smaller monkeys that thrive so well in the tropical forests? Dr. Wilson seems to confound the semi-human and the idiot, but between them we can find nothing in common, and wonder that "the half human intellect," is to him so difficult a matter to realize. Natural selection places all other life — or other agencies, if you will, effect it — in positions favorable to growth and increase, and why not an ape, less brutish than the gorilla, and even less human than the Bushman described by Lichtenstein as presenting "the true physiognomy of the small blue ape of Caffraria." (Quoted by Lubbock, in Origin of Civilization. London, 2d edition, p. 8).

While making many references to various savage races, Dr. Wilson argues really that man is man, of the calibre and ability of the great discoverers, rather than a species of many races, or a being of several species. Mere denial goes but a little way on this assumption. He overlooks that really but a mere handful, as it were, of the human species have effected that advancement which simply benefits the whole. China could never produce a steam engine except as a copy; and the Algonquin Red Indians of this continent are as permanently hunting tribes, and nothing more, as the moon to Caliban was the "lesser light" in comparison with the sun. So there is a vast difference in the mental calibre of the monkeys, which evolution could alone have brought about; and the Kumbekephali, that Dr. Wilson so ingeniously brought to light from their hoary graves in Scotland, gradually evolved all those capabilities which the relics of the graves have shown, as interpreted by the learned author of "Prehistoric Annals of Scotland," that they were finally possessed of.

The third chapter, entitled "Caliban's Island," is again an equal mixture of ethnology and the drama; but the conclusion, leaving Shakespeare's home of Caliban at rest, takes up the question of the home of those hypothetical apes that in their own onward march of improvement are asserted by the evolutionist to have given birth to man. Dr. Wilson cannot see in Borneo an island

suitable for such a process, and denies that such an "Eden" as Hæckel's Lemuria could have existed; but does not give conclusive reasons why such was not formerly the case. How is it possible that the surface of the earth can now be correctly delineated, as it was in the Miocene period, when the first man probably appeared?

Whatever may be the truth of man's origin, it has at least been proved that it has taken unnumbered centuries for man to become what a few of his numbers now are; and, again, that so-called savages are not a result of racial degradation. With these facts, as we consider them, prominent in the mind, as we read of Shakespeare's Caliban, elucidated by Dr. Wilson's ingenious pages, we cannot but think that there is a balance in favor still of Darwin's theory, and that the greater difficulties in the way of absolute proof have not been touched upon by the author of "The Missing Link." — C. C. A.

Ornithology of the West.*— Our notice of Mr. Allen's article has been unavoidably delayed, and even now we can do little more than call attention to one of the most important of the year's contributions to North American Ornithology — a telling paper, worthily succeeding the author's "Florida." As Director of a scientific expedition from the Cambridge Museum, Mr. Allen explored the greater portion of four territories, collected some two thousand specimens of over two hundred species of birds, besides much other material, and made extended observations, especially in the matters of geographical distribution and climatic variation. The range of the species is exhibited by means of eight separate local lists, while a ninth gives a digest of the whole. The faunal catalogues are severally prefaced with topographical, climatic and other data of important bearing and enlarged with various interesting biographical notes.

Questions of variation in specific character according to extrinsic physical agencies are discussed throughout the paper as they successively arise, and, we need not add, with the author's recognized impartiality and ability. The observed facts receive, on the whole, what we believe to be their true interpretation. We have no space to occupy with details, for which we must simply refer to the

* Notes of an Ornithological Reconnoissance of Portions of Kansas, Colorado, Wyoming and Utah. By J. A. Allen. Bull. Mus. Comp. Zool. iii, No. 6, pp. 113-183. July, 1872.

memoir itself; but some points of general moment may be briefly noticed. Mr. Allen describes or otherwise records, but without naming, "several well-marked geographical races not previously chronicled;" and claims, as unquestionably he may, "a confirmation of all the general conclusions arrived at in my [his] recent paper on the 'Winter Birds of East Florida.'" Most of these varieties hang upon the law, which we believe Mr. Allen was the first to apply to our birds, if not the first to announce, that, other things being equal, intensity of coloration varies directly with the mean annual rainfall. Its extreme manifestation, in the bleached forms of the American desert, have before been noticed; but its universal operation seems to have been hitherto unregarded. Color-characters of birds are thus correlated with the three leading surface conditions — forest, prairie and desert — and proven due to the same meteorological causes. We believe this law to be one of the soundest and broadest ever applied to the study of birds. Variation in the size of peripheral parts inversely with latitude is a second proposition Mr. Allen has elucidated and sustained by numerous observations; its full bearing is probably yet to be determined, since for the present it lacks the stability and unequivocacy of the other. We find that most of the "new" geographical races noticed by Mr. Allen depend upon one or both of these laws. One of the most noticeable, and, its authorship considered, one of the most unexpected, features of the present paper is the recognition of numerous races by *name* — a mode of treatment that we heartily endorse. As many of our readers know, ever since Mr. Allen applied the entering wedge in the locally famous case of *Turdus Aliciæ*, he has made variation his specialty, and lost no opportunity of showing intergradation of forms once considered specific. It is undeniable that, spurred by enthusiasm of discovery and zeal of earnest conviction, he occasionally overshot the mark — indeed, this present paper shows he is himself aware of this, for he has already taken apart some of the crude synonymical lists that marred "Florida," and given a "name" as well as a "local habitation" to many varieties he formerly ignored. We believe him to be now treading on sure ground, with far less to regret for the past than is the common lot of the advocates of innovations that mean iconoclasm. The past year has witnessed changes in American Ornithology unprecedented since Baird recast the Audubonian model, if not since Wilson took the subject from European

writers to himself—changes not only involving nomenclature and the rest of the machinery, but also profoundly affecting methods of study. It is too early to decide whether the modification was simply the inevitable swinging back of a pendulum that has reached its limit, or whether it was effected—at any rate, hastened—by Mr. Allen's instrumentality. In the latter event, and if the late revulsion proves to be, as it apparently is, a real reform, Mr. Allen's conspicuous connection with the progress of the science at that particular time is to be regarded as singularly fortunate.—E. C.

Intermembral Homologies.* —Since it is not reasonably possible to do justice to this remarkable paper within the limits to which we are confined on this occasion, we must be content to indicate its nature and scope. This restriction is perhaps the less to be regretted because, as some few of our readers may be aware, our own studies of the same subject have run too nearly parallel with Prof. Wilder's for us to have entirely escaped a bias of judgment unfavorable to impartial criticism; and because we would not even seem to seize an opportunity that the office of reviewer affords of arguing in favor of views that both the author and ourselves desire should be left to stand or fall upon their own merits. Searching criticism can only be expected from those who differ, not those who agree. We are satisfied of the soundness of Prof. Wilder's main views of the vertebrate homologies; and if we are at present unprepared to go with him as far as he has gone, this is chiefly because he appears to have pushed past a certain Rubicon that separates the safe logic of observation from the possibly fallible results of speculation. If we were urged to specify what we believe to be a misconception under which our learned friend labors, we should say it were this, as gathered from his collateral writings; that no mental abstraction, whether moral, æsthetic or purely intellectual, can be formed, unless a corresponding material embodiment exists; and that consequently conception of an idea implies that it has some real physical expression. But there is reason to believe in the existence of a class of ideas, conventionally designated as fanciful, to which this hypothesis has no proven application. One of the clearest and strongest points of the paper

* Intermembral Homologies: The Correspondence of the Anterior and Posterior Limbs of Vertebrates. By Burt G. Wilder, S. B., M. D., etc., Proc. Bost. Soc. N. H. xiv, p. 154, *et seq.*, 1872.

is that made on pp. 15 and 17, where, in the hope of closing "the first century of this [the homological] controversy by proposing a view embracing the best elements of both the two great parties, syntropists and antitropists," the author says: "it is probable therefore, that for a final solution of the problem we must combine the *visual* method of Huxley, as based on the facts of position in the embryo and lower animals, with the *intellectual* method of Wyman, as based upon a great law of organization."

The "historical sketch of the question" with which the article opens is a valuable contribution of the literature of the subject, meriting a more pretentious name, since it is a critical summary of most that has been done in this field — one than which few have been more harrowed with so little cultivation. The author continues with a revised nomenclature of parts and of ideas — a bold attempt to furnish some new tools of thought and sharpen others, the success of which can only be surmised, since this depends more upon acceptability than adaptability. Such words as *meros*, *talus* and *genu* strike one peculiarly, while such as *pseudantitropy* and *hypsesyntropy* demand crystallization of the ideas they foreshadow to command general recognition. Much original evidence of the morphical insignificance of numerical composition is adduced in another portion of the treatise; while several general and special problems are presented for future research. May we not confidently look for their solution by an author who has proven himself an earnest, impartial and meritorious investigator? A chronological list of works bearing on the subject, invaluable for reference, closes an article of signal pertinence and acceptability, which becomes at once indispensable to students of philosophic anatomy, and which may not improbably be hereafter recorded as one marking an important period in the progress of that study. — E. C.

Revision of the Echini.* — This superbly printed and lavishly illustrated work is another of the series of Illustrated Catalogues issued by the Museum of Comparative Zoology. It is a general work on the living species of Echini, and from the evident care in its preparation, combining the results of the study of the types of most of those who have written on this order scattered through

* Illustrated Catalogue of the Museum of Comparative Zoology at Harvard College. No. vii. Revision of the Echini. By Alexander Agassiz. Parts i-ii. With 49 plates. Royal 8vo. pp. 378.

all the principal museums in Europe as well as our own country, it must for many years be the standard work on this subject.

The first part contains the bibliography, followed by a chapter on "Nomenclature, which will greatly interest special students in zoology, and we only wish we had room to reprint certain portions. Mr. Agassiz finds that the value of the genera usually recognized, "when tested by our present knowledge of the changes they undergo seems limited almost to convenient headings or keys for the more ready identification of species. Genera, as we recognize them among Echini, are certainly not founded upon features of general and permanent value, but, on the contrary, upon features applying only to a few species, and of very limited application." "In spite of the definite existence of what we call species, genera, etc., when we apply these terms to limited regions and series of the present day, yet we find them totally inadequate to express our wider interpretation when our standards of comparison are infinite in time or space." In illustration of this idea expressed of the shifting nature of generic characters, if we understand our author aright, he says in the preface to his second part that "the number of fossil genera has been increased to such an extent, and they have been based upon features which are here shown [by the study of the young of existing species] to have so little value, that before we can make a satisfactory comparison of the fossil species with those now living, a thorough reëxamination of the fossil Echini from our present standpoint is absolutely necessary."

The "chronological list" contains the history of the names of the different forms of Echini; 116 pages are devoted to synonymy. An interesting chapter on "Geographical Distribution," ends part I. In it he advocates "Lovén's theory of the distribution of life, — of a uniform fauna throughout the bottom of the deeper parts of the Atlantic."

Mr. Agassiz thinks that we now have a very fair representation of the littoral Echini of the world, and as recent explorations indicate that we have hitherto inadequately mapped out the probable distribution of life at great depths, he would wait for the results of such explorations before discussing the subject. He finds that the distribution of sea urchins agrees remarkably with the "great belts of temperature first mapped out by Dana;" and copies them on the seven suggestive maps bound in before the plates.

The second part consists of descriptions of the Echini of the Eastern coast of the United States, with a report on those collected by Pourtalés in the deeper parts of the straits of Florida.

The forty-nine plates are lithographs, Woodbury types and Albertypes, and each is used with great success in delineating these forms so difficult to render, and expensive both as regards time and money. For such objects as Echini photography proves invaluable.

AFRICAN ORNITHOLOGY.* — Those who are interested in this subject will welcome this as a very convenient and useful volume, the entire reliability of which is assured by the author's evident familiarity with the birds treated, as well as by the able critical editorship of his manuscripts. It is likewise a comprehensive treatise, four hundred and twenty-eight species being included. Specimens of nearly all of these have been reëxamined and identified by Mr. Gurney, to whom we owe their nomenclature and arrangement, as well as the technical portions of the work, Mr. Andersson's portion being that of a naturalist in the field. The complete title of the work, below quoted, sufficiently shows its plan and scope, while general praise of the mode of execution would be entirely superfluous. A point of interest for American ornithologists is the authentic record of *Tringa Bairdii*† as a bird of South Africa.— E. C.

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*Notes on the Birds of Damara Land and the adjacent countries of south-west Africa. By the late Charles John Andersson, author of, etc. Arranged and edited by John Henry Gurney, with some additional notes by the editor, and an introductory chapter containing a sketch of the Author's life, abridged from the original, published in Sweden. London. John Van Voorst, 1872. 8vo, pp. xlviii, 394.

† Mr. Harting's supposition that this species has never been figured is not quite correct. Soon after its original description, a life-size colored plate of two figures was executed, I think by Mr. Cassin, in Philadelphia. I had proofs in my possession for sometime before I lost them, and I believe there are others extant in the Smithsonian. But I had nothing to do with the matter, never knew for what, if any, work the plate was intended, and cannot say whether or not it was ever published. The following summary, probably approaching completeness, of the literature of the species, is subjoined for convenience of reference:

? *Chorlito lomo negro* AZARA, sec. Scl. et Salv.

? "*Tringa melanota* VIEILLOT."

? "*Tringa dorsalis* MEYER *et* LICHT."

? *Tringa pectoralis* CASSIN, Gilliss' Exp. 1855, ii, 195.

Tringa Schinzii WOODHOUSE, Sitgreave's Exp. 1853, 100, Excl. syn., nec Brehm.

Tringa Bonapartii CASSIN, Baird's B. N. A. 1858, 722 (*partim*) nec Schlegel. HAYDEN, Geol. & Nat. Hist. of the Upper Missouri, 1862, 174. ("Water courses of the Northwest.")

Tringa maculata SCHLEGEL, Mus. Pays-Bas, *Scolopaces*, 1864, 39 (*partim*).

Actodromas Bairdii COUES, Proc. Phila. Acad. 1861, 194. ("N. Am., E. of R. Mts.")—

NEW SPECIES OF AMERICAN MOTHS.*—Mr. Grote is still supplying us with descriptions of our moths, which will make their study all the easier for students. We cannot agree with him in placing (after Lederer's example) the species of Hypena and indeed all the "Deltoids" among the Noctuids, believing that they run into the true Pyralids, whether we consider the larval or adult characters.

Unfortunately for lepidopterists the second paper we notice is but a fragment. It is a mere outline of an extended memoir in which all the North American species known to the author as belonging to the genus Catocala were fully described. This paper was lost in transportation. This beautiful genus, says Mr. Grote, "seemed to have its largest representation in North America, and to attain with us its fullest development." Fifty-four species are described.

ILLUSTRATIONS OF NORTH AMERICAN ENTOMOLOGY.†—We have before alluded to the beautiful and useful plates which Mr. Glover has for years past been preparing, and now only regret that more copies of the present work have not been struck off. The volume before us is one of the most important works on entomology that has appeared in this country. On the thirteen large plates are crowded admirable colored figures of every kind of grasshopper and allied forms that Mr. Glover has been able to obtain, either from his own cabinet or those of his friends. They are authentically named, according to Scudder's catalogue, and need scarcely any letter-press to enable them to be determined by the young entomologist.

The text accompanying these plates, besides giving full explanations of the figures, contains concise notices of the habits of

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ID., *ibid*, 1866, 97. ("Whole interior of N. Am.")—SCL. P. Z. S. 1862, 369. ("Mexico.")—DALL & BANN., Trans. Chicago Acad. 1869, 292 ("ALASKA.")—ALLEN, Bull. Mus. Comp. Zool, iii, 1872, 182. ("Colorado.")—HENSHAW, Am. Nat. vi, 1872, 306. (Long Island, Mass.")

Tringa Bairdii SCL. P. Z. S., 1857, 332. (Santiago, Chili.")—ID. et SALV. *ibid.*, 1858, 144. ("Conchitas, Argentine Republic.") (Other recorded S. Am. localities are Panama, New Granada (*Salvin*) and Tambo, Peru, (*Whitely*); fide HARTING, NEWTON, P. Z. S. 1871, 57. (Egg.)—HARTING, Ibis, 1870, 151, et apud ANDERSSON. B. Damara Land, 1872, 308 (Walwich Bay, S. W. Africa.)—GRAY, H.-L. 1871, iii, 49, No. 10308.—COUES' KEY N. A. BIRDS, 1872, 255.

*On the North American species of Catocala. Jan., 1872, 8vo. pp. 28. Description of North American Noctuidæ, No. 2. Sept., 1872. 8vo, pp. 19. By A. R. Grote. (From the Transactions of the American Entomological Society, vol. iv. Philadelphia.)

† Illustrations of North American Entomology (United States and Canada). By Townend Glover. Orthoptera. Washington, 1872. 4to with 13 plates, pp. 12.

these insects, and an alphabetical list of the vegetable and animal substances injured by them.

It will be of great use to agriculturists, and when the author feels tempted to issue an edition for the public (the present edition of fifty copies is intended for distribution among entomologists and entomological societies only) we are sure that the work will be highly valued.

Mr. Glover proposes to "publish yearly, or from time to time, additional plates, etc., of the same size and in similar style, of any new or rare Orthoptera which may be added to our list by the expeditions or by private enterprise, as likewise, eventually to illustrate all the other orders of insects in a similar manner."

THE FORMS OF WATER.* — Prof. Tyndall leads off in the admirably projected "International Scientific Series," which we owe to the earnest efforts of Prof. Youmans, and the energy and liberality of the Messrs. Appleton. We are so late in noticing the present attractive volume that probably most of our readers have bought it. Those who have not seen it have a rare treat in store, as it fully equals Tyndall's other works in the lucidity and interest of its style, and is of special value as giving in a simple, condensed form the views of the pioneers in glacial studies. The series comprises a large number of subjects to be treated by the leading scientists of the old and new world, and when completed will form an admirable library of science.

PHYSICS AND POLITICS.† — This little volume, consisting of six essays, may fairly claim, we think, to be considered a valuable addition to anthropological literature. It certainly is strictly scientific throughout, and commends itself, by its clear statements of facts, to the intelligent reader. It is not merely an outline of the works of others, or an attempt to popularize the history of the human races of prehistoric periods.

Mr. Bagshot takes up the subject of the very early condition of mankind, and while viewing him in a light quite different from that either of Lubbock or Tylor, yet draws the same conclusions: and

*The Forms of Water in Clouds and Rivers, Ice and Glaciers. By John Tyndall, LL.D., F.R.S. With thirty-five illustrations, etc. New York, D. Appleton & Co. 1872. 12mo, pp. 192.

†Physics and Politics; or, Thoughts on the application of the Principles of "Natural Selection" and "Inheritance" to Political Society; by Walter Bagshot, Esq., New York: D. Appleton & Co: being the Second Volume of the International Scientific Series.

brings forth more facts for the theory, now established, that man's original condition was one of barbarism — one, in which, the bestial predominated. This theory, in fact, needs no further demonstration, and may be said to be accepted by the scientific world.

The essence of the argument of the first two essays is that man early secured a modicum of law, as shown in selecting one as a leader; and as that tended to bind together each little community, so it became powerful and warred successfully with the neighboring men, who were held in no restraint, by the *natural* selection of one of superior parts, who would be a leader, by the admiration he caused among his fellows.*

When this "law" was powerful enough to make men mere facsimiles of other men, progress was at an end — the imperfectly developed civilization crystallized. "Progress," he says "is only possible in those happy cases where the force of legality has gone far enough to bind the nation together, but not far enough to kill out all the varieties and destroy nature's perpetual tendency to change."

This argumentation is carried out more fully in the following chapters on "Nation making" and the "Age of Discussion;" and as the author never loses sight of the theory of evolution, "which, if it be not proved conclusively, has great probability and great scientific analogy in its favor," it is interesting and instructive to the scientific reader to see these principles, which are so generally applied to mere genera and species, successfully, we think, handled in the elucidation of some puzzling anthropological problems. — C. C. A.

Popular Science Monthly.†—After carefully reading this journal, since its first appearance nearly a year ago, we can say that it is doing a good work for science in this country by commending the labors of scientific men, and raising the minds of the laity into the scientific atmosphere. Scientific thought is something distinct from the average thought of our age and people, whether expressed

*Mr. Bagshot only proposes to explain how the various nations may have arisen, and not how the well worked races became so distinctly characteristic as they are. This subject he touches upon, but only to refer to it. There seems much probability however in the suggestion, that natural selection, in races, as in nations, produced the differences as they now exist, but it may be, at an earlier period, when mankind was more pithecoid in his nature.

†The Popular Science Monthly. Conducted by E. L. Youmans. New York; D. Appleton & Co. 8vo. Each number 128 pp. With illustrations.

in our commercial, literary or religious papers. It is the mental air that Galileo, Goethe, Newton, Kant, Linnæus, Cuvier, Rumford, and the scientific lights of our own day have created; and nothing but sound mental health, a hearty love of truth, and greater happiness will result from breathing such air. Science is the expression of the common sense of all ages. It tends more than any other study to develop common sense in the individual.

This journal does not cultivate a special department of science but aims at persuading men that science is to be cultivated not only for its own sake, but as directly increasing human health and happiness.

The only fault we have to find is that the papers, most of which are selected from the scientific thinkers of England, do not perhaps fairly represent American thought, for certainly we have men of as much ability as the authors of many of the papers that have been reprinted in this journal, could they be induced to write. Again in the department of Reviews is an excellent opportunity, of which due advantage is not taken, of eliciting the best thought of our working chemists, naturalists, geologists and astronomers. American scientists have a duty to perform in impressing the value of science upon our politicians and rulers. We believe in the Platonic marriage of Science and the State.

Half Hour Recreations in Popular Science.*—This admirable series of reprints contains papers entitled "Strange Discoveries respecting the Aurora and recent Solar Researches," by R. A. Proctor; "the Cranial Affinities of Man and the Ape," by Prof. R. Virchow; "Spectrum Analysis Discoveries," by the editor; "Nebulæ, Meteoric Showers, and Comets; and Unconscious Action of the Brain, and Epidemic Delusions," by Dr. Carpenter. Prof. A. Winchell has prepared a number on the "Geology of the Stars" which is in press. This series is to be followed by the publication of "Half Hour Recreations in Natural History," to consist of several volumes, entitled "Half Hours with Insects, with Birds, Wild Animals, Domestic Animals, Reptiles, Plants, Trees, and Fishes. Each volume is to be carefully prepared by an expert. We are glad to have such works freely disseminated. They are popular in style and will be found to be very readable by persons not versed in science.

*Half Hour Recreations in Popular Science. Dana Estes, editor. Estes & Lauriat, Boston. 12mo. Each number 32 or 36 pages. With illustrations.

A New Theory of the Origin of Species.* — We have here an essay illustrative of the general principle, that confidence in the discussion of great problems of modern science is in inverse ratio to a knowledge of details. The author has undertaken as his first work to handle the most difficult of scientific problems, commencing at the top instead of the bottom of the scale of work which the student must pursue in order to reach conclusions which rest on a solid basis. The result is naturally a production scientifically worthless. His theory, that each new specific form is produced from the matrix of a preëxistent species by supernatural creative power, is only a form of the old belief in distinct creations, and is not a developmental theory in any sense. He produces no evidence in support of it; in fact, he does not appear to know what scientific evidence is. This further appears in the inconsistency of his belief in the development of species by descent. In evidence of this he cites the arguments adduced by some well known European authors, with reference to the succession from less to more perfect, exhibited by classification and palæontology. With the works of American scientists he appears to have little or no acquaintance. Occasionally, novel and erroneous statements are made; *e. g.*, "The Icthyosaur is between the predaceous fishes and the crocodile!" "In this era the fierce Saurians make their appearance in the *Megalichthys hibbertii*!" Trilobites are defined as "a three lobed animal, in general figure something like the wood-louse." The *Mosasaurus* "a huge reptile twenty-five feet long" is referred to the *Eocene* formation (!) and is said to be "intermediate between the *monitor* and the *Iguana*." A slight knowledge of American palæontology would have prevented such blunders. The early part of the paper is occupied by arguments of the popular sort against descent by generation. He lays especial stress on the size of the human brain as compared with that of the apes, forgetting that the canary's brain is relatively still larger than that of man.

The author expresses himself clearly and distinctly, and we hope that his pen may in future find abundant occupation in relating his studies into the structure, embryology, and other details of biology, which are essential to the discovery of the laws of creation. In this we prophesy for him success. As it is, he is now evidently

* A New Theory of the Origin of Species. By B. G. Ferris. New Haven, Conn. Chas. C. Chatfield & Co.

a book zoologist. Work in the shop (which we hope he will undertake) will correct his views and give him a place among his friends, American zoologists. In the meantime let him look up the orthography of the words carnivorous and herbivorous. — E. D. C.

BOTANY.

Cultivation of California Roots and Bulbs. — In a climate like ours, clearly discriminated by a wet and long dry season, we find these bulbs located say about six to ten inches deep: the vital fibres, or true roots, shoot downwards ten inches to a foot below this point, in search of food and moisture: thus radiating from the leading germinal end of mostly oblong scaly bulbs — the respectively dormant fibres that have "closed in" serving as stays, etc. Is it not evident, then, that such bulbs require a flower pot at least eighteen inches deep? Hence, ordinary pots must be *utterly useless*, cramping the plant, or inadequate to meet its primary natural indications. Let any one take an improvised five-gallon kerosene or alcohol tin can, or the like, which is good enough, not to say the best, cut out one end and nail narrow slats around the upper margin to add symmetry, avoid unsightly dents, and for convenience in handling; and if one slat is dressed, paint the name, to avoid annoyance of displayed labels; paint rudely inside and out, to preserve; punch say at least three large holes in the bottom; plant, as in nature, in any good soil well composted, and set your can, keg or crock, *in a shallow pan of water*. You will soon have the pleasure of seeing a stout stem, of the size of your thumb, rising up and "rejoicing as a strong man to run a race," and flowering gorgeously. Let it generally be observed here, once for all, that in California *underground* irrigation, or water supply from beneath, is the requisite rule or law to be observed, especially in their advanced stage of growth. Many California plants are not only injured but killed outright by spraying beneath our California sun. To illustrate these principles, let us take a few other examples, to show that if a plant spends its vital force searching for requisite food or moisture; or, if the law of supply be reversed, efforts balked, or attained at too great an expenditure, little or nothing else can be accomplished. *Abronia arenaria*, as the specific name indicates, grows in sand. If found on deep sand-drifts of the bay shore of San Francisco, or inland, it shoots down a stout fusiform

root of indefinite length; but often poor and puny is the top, that creeps not far from the crown, with perhaps few flowers and little fruit. But mulch a moist, black, brackish, cracky soil, with only six or eight inches of sand, and it will go down to, or a little into it, spreading abroad its forked subdivisions and fibres, almost or quite horizontally; the crown-sprouts now run riotously, mantling the sand with vines, full of pink flowers in fruitful umbels unnumbered. Often one spray of water *above* will kill it entirely; or, the root remaining, it will sometimes come up and flourish again if surface irrigation is neglected, even *two years* afterwards. A similar short horizontal spread of root is seen with *Alfalfa*, on tule or lands fairly shaking and rocking with a peaty carpet; and so of a thousand roots, otherwise exceedingly deep, and prone to delve. The legitimate practical inferences we leave to the good sense of every enlightened stock-raiser, farmer and cultivator.

Florists are apt to complain that many of our bulbs ere they bloom lose one essential beauty of plants, namely, their *radicle leaves*, which, they say, "dry up, and leave the stems looking naked and bare. They are frequently found upon exposed hills and slopes, rocks, etc., descending down dry and very hot valleys, into debris and alluvial bottoms, where sand or loam with *underground moisture* abounds. The very same plants are seen to rejoice best where they find some shade and shelter; otherwise, they bespeak a struggle for existence, *i. e.*, their leaves prematurely or naturally dry up early to save exhaustion. In half shades, along high banks and slopes, contiguous to creeks, with adequate subsoil moisture, we see *Cyclobothra alba*, with long and beautiful glaucous leaves, say an inch and a half wide and eighteen inches to two feet in length, accompanying the flowers, ten to twenty in number; the golden *C. pulchella* and most others tolerate more sun and drought, with their companions the manzanita (*Arctostaphylos glauca*), oaks, etc., near whose shades it is wont to linger; but its best forms love rich, rocky, half shady drains — leaf and flower companions to the close. Witness *Seubertia laxa*, two to four feet high; the same *Dichelostemas* and *Brodiæas*, with ten to fifty flowers, and green leaves in similar grace and completeness of beauty. The list might be extended beyond the reader's patience; what we desire to say and impress is, that the same plants exposed are barely one quarter as large, and with no green leaves at all, or at best a poor apology for them; and so of numberless others.

Erudite and complex recipes relative to proper mixtures of soils, and common management may well be left to the knowledge and judgment of those who believe in them. With such a wealth of sunlight and heat above as falls to the lot of California, and no lack of the commercial medium, moisture, below, I see no reason why we may not allow Nature, under human hands, to grow her fragrant white Lady Washington lily six or seven feet high, with ten to thirty or more flowers, just as we see it wild. *L. Bloomerianum*, too, is a perfect giant among lilies, when at its best — a right super-royal display — the Divine Teacher himself being judge. Nor why *L. superbum* in a southern bog should be eight feet high, with the best part of a hundred flowers, as we have seen it there, and still the marvellous beauty is ever new as we retrospect. Even our *little* orange *L. parvum*, I found at the Sierra summit over five feet high and fifty flowers — *carefully counted* — but the plant was sheltered and shaded by an old emigrant water-tank stilted up, now dry and long ago abandoned, but its roots found a fair supply of *water from beneath*. — Dr. A. Kellogg, *in the California Horticulturist*.

On Drought in its Relation to Winter-killed Trees.—I was pleased to note how near Prof. Shaler, by a single season's observation (see Vol. vi, p. 671), came to a correct theory of arborescent destruction in winter, which it took me some years to discover after a comparison of numerous facts, — namely, that trees commonly hardy, when they are killed in winter, are destroyed by evaporation, in the same way that they are by drought in a dry summer.

In my younger horticultural days, if any one had given thought at all to the process of destruction, it was to believe that frost expanded the sap in the cells which consequently became ruptured, just as frozen liquid splits a bottle. It fell to my lot to combat this view, and to show that it was evaporation and not expansion. I need not here detail the facts on which this law has been founded. The readers of the "Gardener's Monthly" are familiar with them, and a reference to the Index of the past twelve volumes will readily direct others who have been outside of the horticultural pale, for it is essentially a field for the observing horticulturist to cultivate.

Prof. Shaler was quite right in doubting whether it was the intensity of the cold alone which destroyed the trees, but he is not

quite in accordance with the fact in his suggestion that it was after the frost left the roots that the injury began. If Prof. Shaler will remember that there is an enormous evaporation going on from plants exposed to a dry atmosphere, and that this takes place whether there be frozen soil about the roots or not, he will I think understand how a plant may become exhausted of itself, without waiting for the thaw. If there be a very dry atmosphere, and the roots nearly all encased in frost at the same time, it is still more difficult to supply this waste. The deeper the frost the greater the difficulty, and the more evaporating surface, as in evergreens, the greater the risk.

The destruction by drought and not by the absolute degree of frost being conceded, there remains nothing but to apply the law to general science as Prof. Shaler suggests; a dry atmosphere becomes a destructive agent as well as frost, and those plants which part with their moisture the most readily, as a climate passes from moist to dry, must be the first to disappear. In my grounds I had large quantities of American hornbeam side by side with the English species. These last were all killed to the ground,— the others uninjured. This shows that the American species can resist evaporation better than the European. It is difficult to decide from an evolutionary point of view which of these two very closely allied species had the priority of origin. If we accept the proposition that in water was the beginning of plant life, we might infer that development has been in the direction of the dry atmosphere, and thus arrive at the conclusion that by natural selection the American is an offshoot from the European. In my grounds also the Liriodendron suffered terribly. I had ten thousand from one to five feet high killed to the ground, but all above this were uninjured, as their roots were deep in the ground, and could supply the waste of sap without much destruction from the frost. But the fact of the younger ones drying up so easily, shows that this tree was not created for a dry winter climate. We must infer that they are either immigrants, or that the climate has changed since their first appearance. And then again arises another suggestion. Suppose the future seasons should regularly repeat the last, would "natural selection" be sufficient to produce some less liable to loss by evaporation, as we have supposed may have been the case with the hornbeam? Would this change to a greater winter aridity, if continuous, give rise to a new species of Liriodendron?

These are some of the thoughts suggested by Prof. Shaler's paper. They are mere "speculations" it is true, but the imagination, under proper control, is a great aid to investigation. If we suspect something we may be led to look for the evidence; and thus learn long before those who wait to stumble on the truth.—T. MEEHAN.

INFLUENCE OF FOREIGN POLLEN ON THE PARENT PLANT:—Professor Gray adds (Amer. Journ. Science and Arts, Dec., 1872) another to the already numerous instances, says the "Academy," which have placed this mysterious phenomenon beyond dispute. An apple (Spitzbergen) produced a fruit half of which was (at least as to the surface) Spitzenberg, the other half russet. A tree of the latter fruit stood about two hundred yards off. The division into two exactly equal parts is quite unexpected; as the styles and carpels were five, we should have expected the division to be into fifths. Moreover, the action of the pollen in this case is, morphologically, on the calyx, not on the pericarp.

We have been told on excellent authority that apples have been raised in Hopkinton, Mass., which were half sweet and half sour, the line of demarcation being very distinct, so that the distinction in this case was more than skin deep.

[The apple in question was received from the Smithsonian Institution, with an account of its history, and a statement that one or more similar apples had been already received at the Agricultural Department, Washington, and preserved in wax models. Although the external line of demarcation was perfectly distinct, we are bound to add that, on cutting it up and distributing portions among the members of our botanical class, about half the tasters pronounced the morsels to be russet which were taken from the Spitzenberg side of the apple, or *vice versa*. But the fruit was hardly ripe enough.—A. G.]

ZOOLOGY.

A NEW SPECIES OF SPARROW.—Ornithologists will be interested to learn of the recent discovery of a sparrow belonging to the genus Centronyx, a genus heretofore represented in collections only by the unique type of *C. Bairdii* collected in 1843 by Audubon. The sparrow in question has been minutely examined and compared with the above mentioned type of *C. Bairdii* by Mr. Robert

Ridgway, of the Smithsonian Institution, who has kindly furnished me with the results of his examination.

The following is a description of the bird. :—

CENTRONYX OCHROCEPHALUS Aiken.—Specific characters :—ground-color of the head deep ochraceous, deepest on top, and gradually fading to buffy-white on the throat; feathers of the crown with broad medial stripes of deep black, these narrower and sparser medially, so as to produce two dusky lateral stripes, and a light medial one. A distinct black spot behind the upper posterior corner of the ear-coverts, a smaller one at the middle of their posterior edge, and two black stripes bordering the light ochraceous maxillary one, a narrow rictal stripe along the lower edge of the ear-coverts, and a heavy "bridle" on each side of the throat.

Lower parts buffy-white, purer posteriorly; jugulum crossed by a series of heavy cuneate streaks of deep black, these continuing backward along the sides, but becoming reddish on the flank. Dorsal feathers hair-brown, with black centres, and broadly bordered, both laterally, and terminally, with creamy-white; rump and upper tail-coverts similar, the feathers with black shaft-streaks. Wings reddish-gray, the feathers blackish centrally. Tail-feathers black, skirted with pale ochre-grayish, this becoming pure white on the outer pair of feathers on each side, the exterior of which are pale gray centrally.

Wing, 3·00; tail, 2·40; culmen, ·45; tarsus, ·85; middle-toe, ·63; lateral toes, ·20 shorter; hind-toe, ·35.

Habitat. — El Paso County, Colorado.

Though evidently closely related to *C. Bairdii*, this bird seems to differ specifically in quite different proportions, and also apparently, in different coloration, though the type of *C. Bairdii* is in such worn and faded plumage, that its perfect dress cannot be ascertained satisfactorily.

The differences of form and proportion between the two species of Centronyx are as follows :—

C. BAIRDII. Tail doubly-rounded, the lateral feather as short as the middle one, and about ·20 shorter than the longest; wing, 2·80; tail, 2·10; culmen, ·50; tarsus, ·90; middle-toe, ·60; hind-toe, ·40; its claw, ·40.

C. OCHROCEPHALUS. Tail deeply emarginated, the lateral feather longest, and ·20 longer than the middle; wing, 3·00; tail, 2.40; culmen, .45; tarsus, ·85; middle-toe, ·63; hind-toe, ·35; its claw, ·30.

Of the habits of the bird, I can at present say but little; the single specimen obtained, was found on the dry open plains, many miles from timber. Its actions appeared to resemble those of *Coturniculus passerinus*. — C. E. AIKEN, *Fountain, Colorado*.

INSTANCE OF SAGACITY AND AFFECTION IN A DOG.—On the afternoon of January 4th, Mr. F. W. Crosby of this place, while walking along the bank of Clear Creek, observed two dogs. A black Newfoundland dog (male) and a small white dog (female) playing together on the ice in the creek. While Mr. Crosby's attention was diverted for a moment the white dog disappeared from sight,

having fallen through a hole in the ice, and the black dog was working with might and main to make a hole through the ice several feet below where his mate fell in.

The creek at this point is shallow and quite rapid, so the dog was carried down stream but a few feet and lodged against a stone.

Mr. Crosby not realizing then the true condition of things, or that he could be of any assistance to the drowning dog, passed on.

Returning by the same place in about half an hour, he noticed that the black dog had succeeded in making a hole through the ice, had drawn his then dead companion from the water, and stood over her, as if trying to warm the lifeless body. The ice where the dog made the hole was one and one-half inches thick and strong enough to bear a man. The dog worked with such energy as to cut his feet and mouth quite severely.

This occurred about 5 P. M. The next morning the dog was still on the ice walking slowly back and forth near the body of his companion, and he had evidently remained there during the whole night, although it was very cold and stormy. — W. O. C.

The Food of Diptera. — That certain kinds of flies, especially many belonging to the order of Syrphidæ, live to a great extent on the pollen of plants, was first pointed out by Dr. Herm. Müller of Lippstadt (see Naturalist for July, 1871, p. 390), who described the process by which they accomplish the chewing of the pollen-grains and the severance of the threads by which they are frequently held together, by means of minute denticulations at the end of the proboscis. This statement is in opposition to the views of many entomologists, who hold that, not being provided with mandibles, the Diptera must depend mainly or altogether on fluids for their nourishment; but it has recently been confirmed by the observation of some English naturalists. Mr. A. W. Bennett has examined under the microscope the contents of the stomachs of several Syrphidæ, especially *Eristalis tenax* and *Syrphus arbustorum*, and finds them loaded with pollen-grains belonging to some composite plant, presumably an Aster; and one of the first English entomologists, Mr. Edward Newman, states in the "Entomologist" for January that "Eristalis feeds chiefly on pollen, and most of the Syrphidæ follow its example; the common house-fly eats various solids, and masses of these substances may be found in

the stomachs of these Diptera undissolved and unaltered after passing through the entire length of the leathery and extensile proboscis."—A. W. B.

NOTE ON CASSIN'S PYRRHULA.—Ornithologists have generally accepted the *Pyrrhula Cassini* Baird from the Yukon region, Alaska, as a valid species, the essential character consisting in the absence of red on the part of the male, and the elongated white spot on the outer tail feather. In a communication presented at the eighteenth meeting of the German Ornithologists' Association, Dr. Cabanis referred to a *Pyrrhula* from Lake Baikal, having very much the character of *Cassini;* and at a meeting of the society held in Berlin, on the 3d of June, 1872, this determination was re-affirmed by Cabanis, in the strength of three specimens lately received from Baikal precisely like the Alaska species, previously described. The bird is said, indeed, to be quite abundant, and its occurrence in Siberia, therefore, removes the difficulty which was felt in assenting to the existence of a purely American species, of a genus that is eminently characteristic of the Old World.

In the same communication by Dr. Cabanis, it is stated that Cassin's Bullfinch was also to be accounted as a bird of Europe, since reference is made by Wickevoort Crommelin, in the *Archives Neerlandaises*, to a bird, killed in a flock of *Pyrrhula vulgaris* in Nov., 1866, which differed from the rest in having an elongated white spot on the inner edge of the outer tail feathers. (Cabanis' Journal, 1871; 318; & 1872; 315.)—S. F. B.

HYLA PICKERINGII IN WINTER.—Mr. Samuel P. Fowler, of Danvers, Mass., has sent us a beautiful fawn colored specimen of the little spring piper, or Hyla, which he found, on November 29th, embedded in a heap of grass sods in his garden. We know nothing of the winter habits of our Batrachians and every fact of this kind should be put on record.

APPLICATION OF THE DARWINIAN THEORY TO BEES.—Hermann Müller publishes, in the "Transactions of the Natural History Society of the Prussian Rhineland and Westphalia," an elaborate paper of about a hundred pages octavo, under the above caption. We have already given in the NATURALIST the exceedingly interesting paper by this author from the Italian version, with notes by Prof. Delpino. Space only allows us at present to briefly notice

the chief points made in this second longer article. The object of the present memoir is to show "how in the bees a comparison of those peculiarities of organization which have marked them as useful in aiding the bee in seeking flowers, give us a certain clew in seeking for the ancestry of bees, and the branching out of their genealogical tree."

The memoir is divided into six sections, with the following heads:—

"1. Bees differ from the fossorial wasps only through such peculiarities of organization as adapt them for collecting the pollen of plants and making honey.

2. The above stated peculiarities of bees, which adapt them for gathering pollen and making honey, thus bringing about the differences between them and the fossorial wasps, offer but a slightly interrupted series of modifications from those presenting the most striking differences, to those which in their organization scarcely differ from fossorial wasps.

3. The bees have thereby so branched out as independent families from the fossorial wasps, that certain species are circumscribed to the maintenance of their brood upon honey and pollen. When this limitation became a hereditary trait, there began a differentiation of their posterity, and so extensive opportunity for the firm establishment of manifold adaptations for the most advantageous mode of collecting pollen and honey. Numerous breaks in the series of relationships of bees have hereby become established through the adoption of new habits relating to the care of their young.

4. The branching off of the bees from the fossorial wasps, and the division of the family of bees into special branches, have resulted merely from the modifications in the structure of the females. Importance of secondary sexual differences for the recognition of connection by relationship of genera and species. Preliminary view of the same.

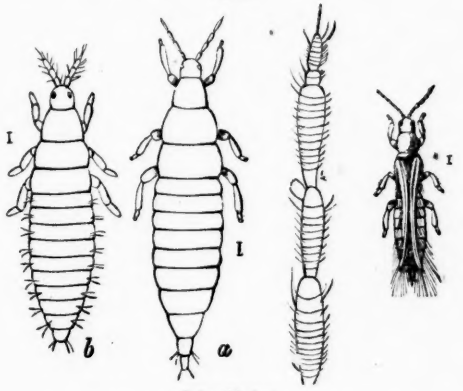
5. Numerical relations of males and females. Qualifications of the males which aid them in seeking the females. Peculiarities of the male antennæ. Why the antennæ are to be regarded as organs of touch and hearing. Peculiar kinds of motions of males.

6. In former times the efforts to effect sexual union brought about secondary sexual peculiarities."

The Thick-billed Guillemot. — A specimen of *Uria arra* Pallas was shot on the Lamoille river, at Fairfax, Vt., about the middle of last December. The bird was nearly full-grown and in good condition. So far as I know this is the first instance of the capture of this bird in New England, except along the shores of the northern portion. — G. H. Perkins.

INJURIOUS INSECTS.—In the last report (1872) on the "Injurious Insects of Mass.," made to the Board of Agriculture, some facts are brought out that may interest entomologists as well as farmers.

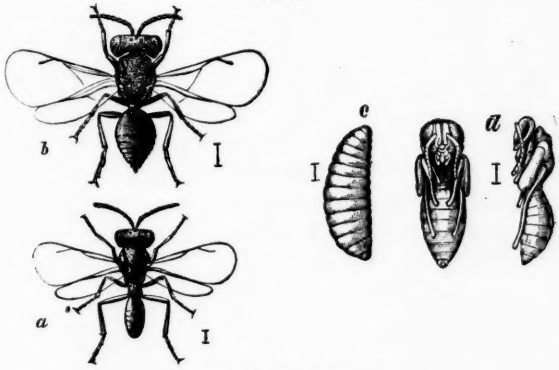
Fig. 41.



Onion Thrips.

A grievous pest to the onion crops of Essex county is the *Limothrips tritici* of Fitch, who found it on the blossoms of wheat and

Fig. 42.



Parasite of Cabbage Caterpillar.

clover. The insect* occurred in all its stages (Fig. 41, male, and end of antenna of male; *a*, female; *b*, larva) on the leaves of

* We are indebted to the kindness of Hon. C. L. Flint, Secretary of the Board of Agriculture, for the loan of these cuts, from the Annual Report on Agriculture for 1872.

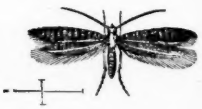
onions, and by puncturing them, destroyed about $10,000 worth of this valuable crop in Essex county alone in the summer of 1871.

The parasite of the imported cabbage caterpillar is described and figured (Fig. 42, *a*, male; *b*, female; *c*, larva; *d*, front and side view of pupa). To Mr. A. G. T. Ritchie of Montreal is due the credit of first making known the history of this invaluable insect. We have raised many of them from the caterpillars in the autumn. It is the *Pteromalus puparum*, and has been known to be a native of Hudson's Bay Territory since 1844, so that it could not have been introduced with the *Pieris rapæ*, its host.

Fig. 43.

Tachina larva.

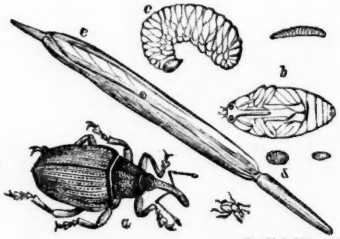
Fig. 44.



Cabbage Web Moth.

Fig. 43 illustrates a Tachina parasite of the same butterfly found by us at Salem. Its imago is unknown. The cabbage web moth (Fig. 44, with cocoon), which is sometimes so destructive, is noticed; also the radish weevil (Fig. 45 from Curtis, illustrates the different stages of the European *Ceutothynchus assimilis*). It is thought that an example (Fig. 46) found about fifteen years ago by the writer, on the radish, in Maine, belongs to this species. In Europe it is said to be very destructive.

Fig. 45.



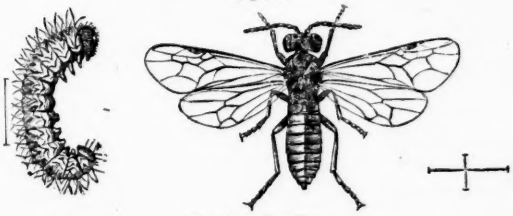
Radish Weevil.

Fig. 46.

Another beetle likely to prove annoying, as we have found it in ferneries and gardens, and which in England is said to be a "dreadful pest in gardens," is the weevil, *Otiorhynchus picipes* (Fig. 47).

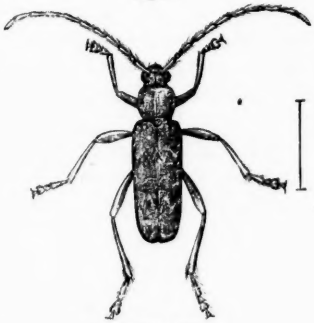
The raspberry saw fly (Fig. 48) is noticed, and the chestnut weevil (Fig. 49), which is thought to be the larva of a species of Balaninus, related to *B. nasicus* (Fig. 50).

Fig. 48.



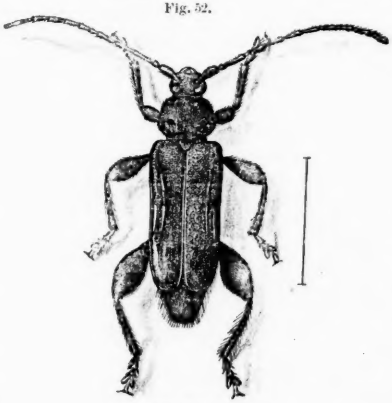
Raspberry Saw Fly.

Fig. 51.



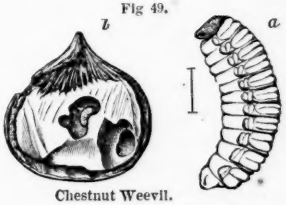
Chestnut Borer.

Fig. 52.



Elm Borer.

Fig. 49.



Chestnut Weevil.

Fig. 47.

Garden Weevil.

Fig. 50.

Balaninus.

INJURIOUS INSECTS.

The chestnut tree has been found to be tenanted by the larva of *Arrhopalus fulminans* (Fig. 51) while a new borer of elm trees has been discovered by Mr. G. D. Smith in the larva of *Physocnemum brevilineum* Say (Fig. 52).— A. S. P.

Professor Cope's Cave Crustaceans. — Dr. Hagen in the last volume of the Naturalist, p. 494, has called attention to the blind crawfish described by Prof. Cope in the article on Wyandotte Cave in the same volume, p. 406, but no one seems to have noticed the peculiar characters of the other crustaceans described in the same paper. As Prof. Cope's article, with its figures, has been copied in "Nature" and republished without change in the last "Annual Report of the Geological Survey of Indiana," and very likely in other places, it seems quite time these remarkable animals should be noticed.

The "Gammaroid crustacean" from Mammoth Cave (*Stygobromus vitreus* Cope) has a description so uncertain and confused that we wholly fail to comprehend the appellations given to the caudal appendages, without supposing Prof. Cope to have entirely misunderstood their structure and relation in *Niphargus*, and consequently in all gammaroid crustaceans. He speaks of the body in *Niphargus* "terminating in a very long style" and of the "last abdominal limb" as "undivided like that which precedes it." The long style must be *one* of the posterior pair of caudal stylets, and "the last abdominal limb" and "that which precedes it" must refer to the first and second caudal stylets, which are not simple but bi-ramus.

The "unknown crustacean with external egg-pouches," referred to the genus *Cœcidotea*, possesses characters before quite unknown among Isopods. The female is described and figured as a Tetradecapod-like crustacean with egg-sacks, like those of many Entomostraca, attached to the extremity of the abdomen, while in the females of all previously known Tetradecapods, the eggs are carried within lamellæ arising from the bases of the thoracic legs. Its supposed affinities with *Idotea* are still more obscured by the only allusion which is made to the mouth appendages, a figure labelled as "the mandible and palpi of right side," with the explanation that "the outer palpus lies above the lateral plate, and its origin was not seen." Although it is difficult to determine what the appendages referred to really are, it seems to be implied that

the mandible was furnished with a palpus, which is not the case in the family *Idoteidæ* as usually understood. As figured and described, it seems to be a form combining characters distinctive of two primary groups of crustacea, and it is strange Prof. Cope should not have seen in it "the type of a peculiar group of high rank." On account of the interest this little animal must excite, it is to be regretted that it was not more fully described, but it is stated that, "the specimens are in bad condition, having lost their limbs, egg-pouches and the distal portions of their antennæ." This is perhaps the most important sentence in the description. The parasite of the blind fish, a Lernæan, described and figured with egg-sacks similar to those of the species just mentioned, is interesting, not only in itself, but for its possible relations to the *Cœcidotea*. Has not the damaged Isopod been carelessly restored with some of the Lernæan's appendages, instead of having retained them from some Entomostracan progenitor by retardation of development? — S. I. Smith.

ANTHROPOLOGY.

Antiquity of Man in America. — In the December number of this journal we made an abstract of a paper printed by the Philadelphia Academy, in which Mr. Berthoud gave an account of the relics of an early race of men. As the geological position of the relics has been questioned, further information is very desirable.

MICROSCOPY.

A Drying Case. — Mr. Wm. H. Walmsley has been using for years, in the preparation of his well known microscopical objects, a very convenient and useful drying case. This case is especially useful for hardening balsam mountings, drying tissues, etc. It is made of tin, heated with hot water and well ventilated, capable of drying one hundred specimens at once, and able to retain its heat for eight hours without attention. Microscopists can obtain it from James W. Queen & Co.

An Object Carrier.—The object carrier usually furnished with the concentric glass stages is extremely satisfactory for studying mounted specimens, but not equally good for other work. It is unsuitable for a large stage plate, or for a heavy trough or com-

pressor unless moving too stiffly for ordinary use, and unavailable where objects are to be dissected and afterwards drawn with the camera or examined with high powers without risk of losing the object. Hence, for a working instrument, Prof. Biscoe prefers to discard the object carrier altogether and place the slide or other support directly on the stage. This is held in position, if the instrument should be tipped, by a brass sliding bar held by two cranked arms capable of being instantly made to move more or less stiffly by means of screws with milled heads. Should it be desired to place the instrument horizontally, for camera work or photography, an extra piece of brass clamps the object in place.

In Zentmayer's new form of students' microscope the glass sliding stage or object carrier is replaced by a glass sliding-bar, which simplifies the work and reduces the expense as well as secures some of the above advantages.

Some object carriers are arranged, and all should be, except in either mechanical stages or very cheap work, so that the sliding movement can be easily controlled by the pressure of milled-head screws.

NOBERT'S LINES. — Nobert has made for President Barnard a two hundred dollar test plate, twenty-band, which claims to reach 224,000 lines to the inch, being twice as fine as the finest lines on the nineteen-band plate. This puts him far ahead of the opticians, and he claims to be prepared to do still better when they overtake him. Who will make the first lens capable of resolving the twentieth-band? Or will those who believe they are able to resolve diatom-markings of equal fineness show it to us now?

RESOLVING-OBJECTIVES.—The editor of the "Cincinnati Medical News" draws very strongly, not too strongly, the distinction between resolving-objectives and those suitable for other work. He has a Powell & Lealand's one-sixteenth which he finds quite useless except for resolving diatoms. We mainly value, at present, the resolution of the famous tests as showing the achievement of a nicety of correction which can be, and should be, applied to the lower-angled working lenses.

MICROSCOPIC WRITING. — This hitherto rare curiosity is now available to all microscopists, both as an elegant toy and as a useful test for the optical qualities of their lenses. The following account, from a paper read before the Queckett Club, gives a view

of Mr. Wm. Webb's unparalleled success in micro-writing on glass. The specimens thus produced are regarded by Mr. Webb as decidedly the best test-objects; and they may be obtained from Mr. Edmund Wheeler of London.

Mr. Webb says: — "I engrave a series of plates with letters measuring from one two hundred thousandth of an inch to one two hundred millionth of an inch. Each engraving is of the Lord's Prayer, varying only in size, commencing about the thousandth of an inch, which is at the rate of over a quarter of a million letters to the inch, and progressively decreasing the size, the next of the series being at the rate of a million letters to the inch, the next two millions, the next three, and the next four million letters to the inch. Having reached this point, and finding the Old and New Testament together consist of three million five hundred and sixty-six thousand four hundred and eighty letters (for the convenience of a standpoint), I say the lastly enumerated test is at the rate of one Bible to the inch and then engrave the next at the rate of another Bible to the inch, and go on decreasing at the rate of a Bible to the inch down to fifteen Bibles, or, at the rate of fifty-three million four hundred and ninety-seven thousand two hundred letters to the inch; but when it is remembered that the letters are written within two parallel lines, with spaces above and below for long letters, and to enable one line to be distinguishable from another, I most respectfully submit that, such letters as "a," "e," "o," and "u," although averaged, with all other letters, with the capitals, and including spaces, at the fifty-three million four hundred and ninety-seven thousand two hundredth of an inch, being actually written within the lines, after allowing for the extra space occupied by capitals, the spaces between words, and the space between one line of writing and the next line, it may be taken that the "e" actually occupies only one-fourth of the average, or, the two hundred and thirteen million nine hundred and eighty-eight thousand eight hundredth of an inch.

The measurement does not stop at this point, as there are other steps to be traversed — as to one, the dot to an "i," I say nothing now. As to the "e," it is self-evident that it is not a spot of black of the previously estimated less than two hundred millionth of an inch, but composed of a bent and twisted line across, and about the two hundred millionth of an inch; therefore, the thickness of the line has to be considered, and, taking that at a lineal fifth of the space, the two hundred and odd millionth would have to be multiplied by twenty-five as the square of five, which would bring the square of the line down to the five thousand three hundred and forty-nine million seven hundred and twenty thousandth of an inch — and do not stop there, for that five thousand millionth is itself loaded in, and consists of abraded black atoms, grated in by the cutting edge of the glass letter, which atoms can

be seen in different aggregations where the line has not been perfectly filled in, and if at the rate of two atoms of black in the square of the line, the five thousand millionth becomes the ten thousand millionth; if at the rate of twenty atoms of black, the size of the atom is the one hundred thousand millionth of an inch.

I now come to the most important and, to my mind, the most interesting part of the subject, which deals with the tests unblackened. For this purpose I must go back to the square of the line forming the letter as the five billion three hundred and forty-nine million seven hundred and twenty thousandth of an inch that, reduced to its square root, gives seventy-three thousand plus of an inch linear as the breadth of the line.

I mount the same series of slides in the way that Monsieur Nobert mounts his justly celebrated tests — without black—and thus open up a wonderful means of study of the whole subject, helping to afford the power of determining at what breadth unblackened lines become invisible, even when aided by the microscopes of the present day. In this instance the seventy-three thousandth is an absolute line, unbroken by a next line.

When viewing the black lines, ordinary direct illumination is sufficient, but when examining the unblackened lines it becomes necessary to adopt in its turn every available means of illumination, because the cut, being wedge-shaped, each side of the cut, from every part to its very apex, both refracts and reflects again and again the light from the other. Again, the original upper and lower surfaces of the glass refract and reflect the light backwards and forwards; again, the top light flows into the cut, helping to produce the climax which blazes away the cut as the light of the sun overpowers or destroys the light of a candle.

By testing by blackened and by plain unblackened letters, it will be found at what point the power of certain objectives ceases to be effective with transparent objects. I can define the smallest Lord's Prayer when blackened, that is, I can define a line of the seventy-three thousandth of an inch, but have never been able to define the same test unblackened. More than that, although I know the exact spot that it occupies, and mark the spot with an Indian ink ring before it leaves the machine in which it is engraved, I have never (perhaps because of irritable temperament) been able to discover not merely the line, but the aggregation of lines forming the two hundred and twenty-seven letters of the very small tests, although they become perfectly distinct when black."

As a test of distortion, Mr. Webb rules fine black lines upon two pieces of glass, and places one upon the stage and the other upon the diaphragm in the ocular.

ANIMALCULES IN BUTTERMILK.—The "Pacific Medical Journal" believes, with much reason, that the abundance of animalcules dis-

covered in poisonous buttermilk by Dr. J. P. Browne, of Galt, Ontario, were developed in the milk after it had been taken from the cow, instead of being introduced into the cow's system with the food and finding their way through the blood into the milk.

NOTES.

When Professor Agassiz gave his opening lecture in the Museum of Comparative Zoology at Cambridge in 1860, he said that American students had been forced to visit Europe, if they were desirous of making any extended study in the natural sciences, but that he intended to reverse this and compel European students to visit America; and by his judicious purchase of type collections abroad (thanks to the liberality of citizens and our State) he has made his promise good.

Professor Henry A. Ward of Rochester, New York, formerly a student of Professor Agassiz, and since Professor of Geology and Zoology in the Rochester University, has, under humbler auspices, long been working toward the same end. His large cabinet of geology and mineralogy at Rochester is well known to many of our readers. He long ago felt the necessity of bringing before the American student examples of those larger and rarer fossils known to geological science, of which only single specimens existed.

For this purpose he visited Europe, engaged accomplished workmen and commenced the foundation of a collection of casts. With untiring patience and sagacity he secured the moulds of nearly everything of importance, at enormous expense, carrying his workmen from one museum to the other, and taking moulds of the choicest specimens, for a period of three years.

The difficulties encountered in some of his experiences would form an interesting chapter. After many difficulties, he managed to secure moulds of the rare Megatherium, Glyptodon, Deinotherium, Diprotodon, Sivatherium, Colossochelys, Mosasaurus, Plesiosaurus, and many other unique specimens in European museums. Thorough and methodical in all his work, he felt that this collection of casts should be symmetrical and complete, as an educational collection, and so was commenced the famous Ward collection of casts. Thousands of dollars were spent in buying especially choice specimens of the obtainable forms solely for the

purpose of making casts from them, and the originals are still preserved in his museum at Rochester. Every educational institution in the country may now possess perfect casts of the rarest fossils, forming exact facsimiles of the unique originals in the British Museum, the Jardin des Plantes, and other foreign museums, besides a representative collection of all that is needed to illustrate geological history.

From this important beginning, Professor Ward has gone on enlarging the usefulness of his work by adding to his stock, skins and skeletons of animals, fossils and minerals, and alcoholic specimens, so that institutions may provide themselves with collections accurately labelled and arranged, without sending abroad for the purpose.

With the capital invested in so large an enterprise, rapid sales must be effected, and one not familiar with the scientific attainments of Professor Ward, and the sole desire that animates him, to spread far and wide the type collections so important for educational purposes, might confound his occupation with that of the ordinary dealer in natural history objects, such as one may find in any large city. While in the latter case, however, with some laudable exceptions, the dealers offer simply the fortuitous gatherings of sailors, comprising curiosities, shells, and detached portions of animals, like turtles' shields, sharks' jaws, and the like, of no intrinsic value, the work in which Prof. Ward is engaged is one of a solid scientific character. His outlays are immense, yet everything he does is done solely in reference to advancing science. He has the endorsement of every naturalist in the country, and already the leading museums in the country are indebted to him for some of their choicest material.

Every scientific man should visit Professor Ward's place at Rochester, New York, and see the bee-hive of industry he has built up around him. We visited Rochester in February, solely for the purpose of examining the new industry. Here one finds several large buildings, besides sheds and yards devoted to receiving, preparing and shipping specimens. There are twelve men constantly employed as taxidermists, osteologists, moulders and carpenters. Two of the osteologists he has brought from the Jardin des Plantes, Paris, where they had worked for a long time under the direction of eminent anatomists. The skeletons and skulls prepared here are beautiful in their whiteness and the elegance of

their mounting. In the University building is Professor Ward's zoological cabinet, still his private property, containing type forms of the animal kingdom. This is carefully labelled and is strictly an educational collection.

In Cosmos Hall is a large room containing a large and valuable geological collection, particularly rich in Ammonites, fossil cuttle fishes, with the ink glands still preserved; beautiful fossil fishes from the Lias of England and Germany; fine Saurians in slabs; Icthyosaurus, Plesiosaurus, Teleosaurus; also the leg bones and other remains of the remarkable Dinornis from New Zealand; Mastodon and other mammal remains, and an almost perfect skeleton of the rare Glyptodon, the gigantic fossil armadillo.

Great interest attaches to this collection since it contains the original specimens of many of his casts, which have already a traditional value, now that so many institutions possess them. This series of *originals* is of intense interest, and will alone give tone and character to any geological cabinet in which they may be incorporated. In this room may also be seen relief maps and various models of geological import; many of these are familiar to College professors through the descriptions and figures given in Ward's "Illustrated Catalogue." At the time of our visit he was packing a series of casts for the Syracuse University, and a Megatherium was being cast for Dartmouth College. A cast of the skeleton of this latter huge animal may be seen in the Geological Hall of the Smithsonian Institution at Washington, where it was placed by Professor Ward, and copies of it are already in several other museums together with other of his specimens. The series of casts have been invaluable in advancing the study of geology, as their possession is just as important to the instructor in this department, as the possession of the manikin and skeleton is to the successful teaching of human anatomy.

The zoological portion of Professor Ward's establishment most interested us. Here all is on the same large scale. In bringing this collection together, Professor Ward has not only visited various portions of this country and Europe, Asia and Africa, but has his correspondents all over the world, and is constantly receiving from them most varied and rare material. While we were there he had just finished the preparation of a giraffe, thirteen feet in height, and was unpacking boxes containing a moose from Nova Scotia, a caribou from Maine, a bear from Pennsylvania, a huge

basking-shark from the Atlantic coast; and, from Professor Agassiz, a walrus, a small whale, and the rare Rocky Mountain goat, to be mounted for the Cambridge museum.

One building is devoted to taxidermy. The upper room in this building is a wonder to behold; hanging from the ceiling are hundreds of skins, including apes, monkeys, wolves, bears, hyænas, lions, tigers, sloths, ant-eaters, armadillos, buffaloes, deer, elk, moose, giraffe, yak, wild boar, peccaries; besides an immense collection of such animals as kangaroos, Echidna, Wombat, Tasmanian devil, Ornithorynchus, Thylacinus and other rare skins. Some huge alligators, turtles and other reptiles completed the display. In an adjoining room are kept fishes, batrachians, and other specimens in alcohol; among these are Lepidosteus, Amia, Menopoma, Spatularia, Scaphiorynchus, Aspidonectes, and other American species of special anatomical interest. Still another building is devoted exclusively to the preparation of skeletons; these are received with the flesh dried upon them, and are subjected to a long process of maceration and bleaching; over fifty vats are ready to receive them. These vats are all systematically numbered, and the most painstaking care is manifested to secure every bone, so that each specimen may be perfect. Custom work is combined with all this; and hundreds of specimens are received from the museums of Cambridge, Boston, Salem, Philadelphia, Albany, and many of our colleges, for the purpose of being properly prepared and mounted.

We have dealt thus in detail that the public may know the true character of the enterprise in which Professor Ward is engaged; and the duty of every one interested in science and education to cordially sustain him.

Professor Ward has by long study and by travel in foreign countries, as well as by his long experience as a professional teacher of zoology and geology, fitted himself for the important and arduous task before him.

He has received the unqualified endorsement of the leading naturalists, and his untiring devotion to the work, and the immense outlays he has made, should be widely known among those who desire to sustain in this country an institution where one may secure the material for the foundation of a museum, as well as examples for educational purposes.—E. S. Morse.

[We had the pleasure last summer of visiting Professor Ward's

Rochester Establishment, and of seeing his important collections. One point which Professor Morse has failed to notice is the work done by Mr. Ward in the matter of blocks, labels, shields, and other appliances for the arrangement of cabinets. He has not only planned, but has gone on and constructed the cabinet cases in Vassar, Alleghany and Pittsburg colleges, in the Orange Judd Hall of Science at Wesleyan University in Middletown, Conn., and in the new Syracuse University. At the time of going to press we are informed that Mr. Ward has been engaged to construct the cabinet cases in the new Geological hall — two hundred feet long — of the Smithsonian Institution. — F. W. P.]

It will be seen by the following circular, issued by Professor Agassiz, that a summer school of science for teachers is to be held on Penekese Island, Buzzard's Bay, next summer. From present appearances we may predict every success in its administration. A rare opportunity, such as we believe no country has heretofore afforded, will be offered to those anxious to study the biology, chemistry, and physics, of the sea. Experts will carry on their explorations during three months, and students will thus under the stimulus of their example, be able to learn how to collect, prepare, and study marine animals and plants. If successfully carried out, this school will inaugurate, we believe, a new system of public instruction, and exert the happiest influence on the future progress of science in this country, which depends more than ever on making original investigators. Without further remark we present our readers with a copy of the programme, adding that those who wish to avail themselves of the privileges of the school may address Prof. Agassiz, or the editors of this journal: —

PROGRAMME OF A COURSE OF INSTRUCTION IN NATURAL HISTORY, TO BE DELIVERED BY THE SEASIDE, IN BUZZARD'S BAY, DURING THE SUMMER MONTHS, CHIEFLY DESIGNED FOR TEACHERS WHO PROPOSE TO INTRODUCE THE STUDY INTO THEIR SCHOOLS, AND FOR STUDENTS PREPARING TO BECOME TEACHERS.

Zoölogy in general, and Embryology of the Vertebrates, by Prof. L. AGASSIZ.

The extinct Animals of Past Ages, compared with those now living, and the Methods of identifying them, by Prof. N. S. SHALER.

Comparative Anatomy and Physiology of the Vertebrates, by Prof. B. G. WILDER.

The Animals and Plants living in Deep Waters, and the Peculiar Conditions of their Existence, by L. F. DE POURTALÈS.

Embryology of the Radiates, by A. AGASSIZ.

Natural History and Embryology of the Mollusks, by Prof. E. S. MORSE.

How to make Biological Collections illustrative of the History of Insects injurious to Vegetation, by Prof. H. A. HAGEN.

Natural History and Embryology of the Articulates, by Dr. A. S. PACKARD, Jr.

Natural History of the Fishes and Reptiles, by F. W. PUTNAM.

Natural History of Birds and Mammals, by J. A. ALLEN.

On Breeding, and Nests and Eggs of Birds, by Dr. THOMAS W. BREWER.

Practical Exercises in the Use of the Microscope, by E. BICKNELL.

Instruction in Drawing and Painting of Animals, by PAULUS ROETTER.

On the Preservation of our Sea-Fisheries, by Prof. SPENCER F. BAIRD.

On Fish Breeding, by THEODORE LYMAN.

The Faunæ of the North Atlantic, compared with one another and with those of other Parts of the World, by

The Plants of the Sea, by

The Physics of the Sea, by Prof. JOSEPH LOVERING.

Physical Hydrography, by Prof. H. MITCHELL.

Chemistry of Feeding and Breathing, by Prof. W. GIBBS.

Chemistry of the Sea and Air, by Prof. JAMES CRAFTS.

The terms of admission, and the day of opening the course, will be advertised as soon as all the necessary arrangements can be made, including information concerning board, etc. It is hoped that the liberality of friends of education may make it possible to offer this course free of charges to teachers and students. A number of aquariums and the necessary apparatus to dredge in deep water will be provided. The Superintendent of the United States Coast Survey and the United States Commissioner of Fisheries have promised their coöperation to the extent of their ability, without interfering with the regular service of their departments. Professors SHALER, WILDER, PACKARD, and perhaps others, may spend the whole, or nearly the whole, season at the school, with a view of superintending the laboratory work, while the other gentlemen will stay there only part of the time, or as long as required by the share they are able to take in the course of instruction.

Excursions will be made frequently to give those present an opportunity of learning how to observe, and also of making collections with which they may teach classes at home.

It is but justice to Professor Shaler to say that the first suggestion of giving such a course by the seaside, was made by him.

In behalf of the Faculty of the Museum of
Comparative Zoölogy in Cambridge, Mass.
L. AGASSIZ.

We are happy to announce that Penekese Island, together with the sum of $50,000 to form a permanent endowment of the school, has been generously presented for the purpose by a gentleman in New York interested in science. Buildings will at once be erected, and the school opened early in July. We shall give further par-

ticulars concerning this munificent and most unexpected gift in our next number.

The annual meeting of the California Academy of Sciences was held on Monday evening, January 6, 1873. The following gentlemen were elected officers for the ensuing year: — *President*, George Davidson; *Vice-President*, John Hewston; *Treasurer*, Elisha Brooks; *Corresponding Secretary*, Henry G. Hanks; *Recording Secretary*, C. G. Yale; *Director of the Museum*, H. G. Bloomer; *Librarian*, C. N. Ellinwood, M.D.; *Trustees*, T. P. Madden, D.D. Colton, Robert E. C. Stearns, Oliver Eldridge. The President, Treasurer and Recording Secretary, are also Trustees, *ex-officio*. The President's annual address shows that an increasing interest in the objects of the Academy is manifested by the public, and that the coming year is likely to be one of material interest in the affairs of the Academy.

A regular meeting of the California Academy of Sciences was held Feb. 18, 1873, in which General Hewston announced to the Academy a magnificent donation from James Lick, in the form of a deed to a piece of property on Market street, adjoining the premises of St. Ignatius College on the east. The dimensions of the plot were eighty feet front by two hundred and seventy-five feet in depth, being one hundred vara lot No. 126. The conveyance of the property is subject to various conditions, the purport of which is that the Academy shall erect thereon a substantial three story brick building, faced with granite, in classic style of architecture, and decorated with emblems of science. The building and property shall be devoted exclusively to the purposes of science; it shall remain unencumbered in the possession of the Academy; no part shall be leased at any time, nor shall its use be permitted for political or religious purposes in any way. It further devolves upon the Academy to secure the fund requisite for the erection of the edifice specified within the period of two years, and to prosecute the project to completion within a reasonable time. The plan of the building contemplates among its principal apartments a library, museum and lecture room. The announcement of this donation excited great enthusiasm.

The President remarked that he felt incompetent at the time to express the sense of the Academy in fitting terms. The Trustees, in considering the project of securing accommodations for the

Academy, had never thought of exceeding an expenditure of $25,000. But this site alone, as he had been assured by competent judges, exceeded in value $150,000. A meeting of the Trustees will be held to-day, when the body will wait upon Mr. Lick personally, and express the thanks of the Academy for his munificent gift.

As a preliminary expression of gratitude, on motion of Dr. Hewston, the rules of the Academy were suspended, and Mr. Lick was elected a life member.

Professor Davidson read a paper, which embodied the results of laborious research, on the probable periodicity of rainfall, being illustrated with diagrams. He believes in a law of periodicity, but the problem of establishing it was an intricate one, and it had not been developed by the observations of a century. The observations of twenty-one years in California had afforded no direct conclusions.

Dr. Hewston read an exceedingly interesting paper, descriptive of the marine animal, a species of Limnoria, which has recently appeared in the harbor and commenced its ravages on the wharves, threatening the certain and speedy destruction of the whole works of the city front, unless some effective means are adopted for arresting its depredations. Specimens were also submitted to the inspection of the Academy, under the microscope.

Mr. Dall read a paper on the avi-fauna of the Aleutian Islands.

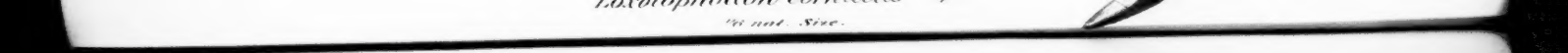
SCIENCE in this state has met a loss in the death of Dr. Henry C. Perkins, of Newburyport, one of the trustees of the Peabody Academy of Science. He devoted much time to microscopical and astronomical studies. One of the leading physicians in this state, he also found time to study science practically. He died very suddenly, February 3d, aged 69.

THE eminent botanist, Professor John Torrey, died March 10th, of pneumonia after a short illness. We can now but refer to the severe loss botanical science in America has suffered from his death.

PROFESSOR SEDGWICK, the celebrated English geologist, died on the 27th of January, aged eighty-seven years. His scientific essays were published mainly in the Transactions of the London Geological Society.

Loxolophodon cornutus Cope.

1/6 nat. Size.



Natural Size.

Lestodelphodon comptus Gipps.

Vic. mus. Spec.